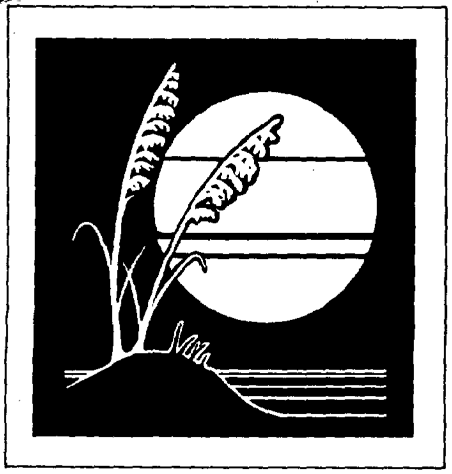

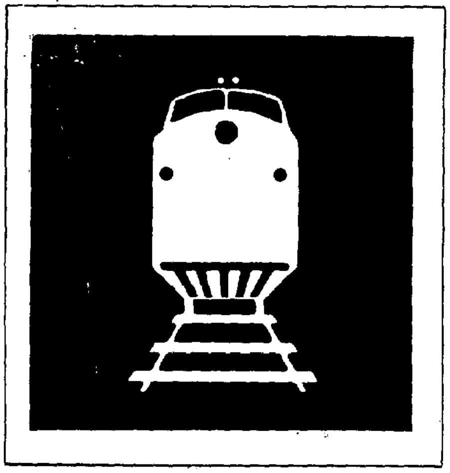

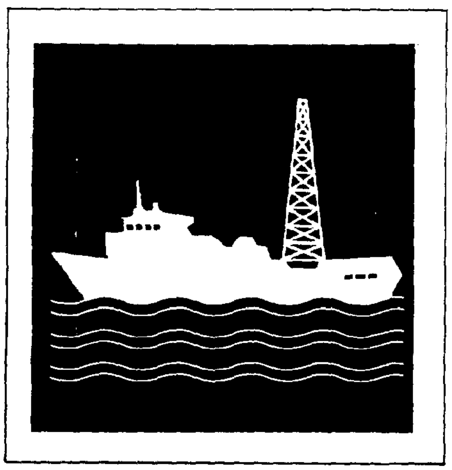

Coastal Energy Transportation Study: An Analysis of Transportation Needs to Support Major Energy Projects in North Carolina's Coastal Zone

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DECEMBER 1980

North Carolina
Coastal Energy Impact Program
Office of Coastal Management
North Carolina Department of Natural Resources
and Community Development

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COASTAL ENERGY TRANSPORTATION STUDY
PHASE I: AN ANALYSIS OF TRANSPORTATION NEEDS TO SUPPORT MAJOR ENERGY PROJECTS IN NORTH CAROLINA'S COASTAL ZONE

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Project No. 79-06

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December 1980

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PREFACE

This report embraces the initial phase of a two-phase study funded by the Coastal Energy Impact Program and conducted during the 1980 calendar year by The UNC Institute for Transportation Research and Education. The output of this Phase I effort focuses on the identification and documentation of transportation needs necessary to support a group of energy projects proposed for the coastal area of North Carolina.

Following a series of interviews with key officials in coastal counties that would be impacted by new energy-related projects, major facilities were identified, energy use scenarios were developed, and transportation needs were assessed. Concurrent with this Phase I study, an impact assessment methodology was developed for Phase II. The second phase will define and evaluate the various social, economic, fiscal, recreational, and environmental impacts that could result from the transportation requirements of the proposed energy projects.

Although not included in this report, an understanding of the objectives of Phase II and the linkages between the two phases is of paramount importance. Phase II, which is being undertaken from September 1980 until August 1982, is divided into two distinct parts:

<u>Phase II-A</u> is an assessment of:

(1) impacts of Outer Continental Shelf (OCS) oil and gas exploration and production activity, with emphasis on the transportation requirements and alternative locations for on-shore support base(s) in North Carolina; and

(2) impacts of coal exports from North Carolina with emphasis on the transportation requirements of alternative locations and capacities of coal terminals.

<u>Phase II-B</u> is an assessment of impacts of transport and storage of all other energy feedstocks and products, including crude oil, refinery products, liquified petroleum gas, peat,

wood, and biomass material. Other energy-related projects may be added at a later date.

Scheduling of tasks in Phase II will permit the study team to complete key activities in advance of certain critical dates. For example, many of the tasks related to OCS activity in Phase II-A will be completed by May 1981 so that state, regional, and local decision-makers involved in the OCS program will have output prior to August 1981, the scheduled OCS Lease Sale #56 by the Bureau of Land Management.

It should also be noted that several energy-related projects which were not publicly announced before completion of this draft report have subsequently been reported by the news media. Specifically, a contract with Alla-Ohio Coal Company to ship three million tons of export coal through the State Ports Authority (SPA) facilities in Morehead City was announced in October 1980, and a contract to construct a $10 million phosphate storage and transshipment facility for North Carolina Phosphate Company, also through the same SPA port facilities in Morehead City, was signed in November 1980.

Also announced in early December were plans by Western Fuels Association of Washington, D.C. to study the use of peat as a boiler fuel for a proposed N.C. Electrical Membership Corporation electric generating station. If the studies indicate that a peat-fired generator is feasible, Western Fuels reportedly will obtain options on enough peat deposits to supply a generating station up to 600 megawatts.

In addition, two other coal export terminal sites are currently being considered along the Cape Fear River--one near Town Creek (site 8) and one at the north end of the SPA facilities in Wilmington. These alternate sites are not included in the discussion in Section 2.6, but will be considered during Phase II. Data on these and other projects not generally available by October 1980 will be monitored and analyzed for their potential impacts during Phase II.

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1.0 PROJECT OVERVIEW

1.1 Introduction

The Coastal Energy Transportation Study is focused on major "key facilities" that are planned or currently under development in the coastal area of North Carolina. Key facilities include (1) improvements or new construction of all types of transportation facilities (including pipelines, terminals and ports, highways, railroads, airports, and water transport) and (2) improvements or new construction of major facilities for the development, generation, use, and/or transmission of energy.[1]

This project also focuses on an assessment of a full range of resources in the coastal area of the State that may in the future be affected by the development and operation of these key facilities. Resources that are considered include human resources as well as economic, recreational and environmental resources.

The results of the first phase of this study, which are presented in this report, show a complete inventory of major transportation and energy projects that are currently envisioned for future development in the coastal area (Part A). Depending on several factors, this listing may change at any time.

A study design for the second phase of this project is also related in this report (Part B). The study design for the impact assessment is sufficiently flexible at this point that it can include an analysis of a reasonable number of additional (or different) transportation and energy projects. At this point in time, it is envisioned that the Phase II analysis will initially emphasize two energy-related projects: (1) coal export terminals and (2) support bases and other facilities related to OCS exploration and development.

---

[1]Projects that are major users of energy have been added for this study. Other key facilities are synonymous with those identified in the Coastal Area Management Act (G.S. 113A-103).

During the course of this Phase I effort, the "level of resource recovery", development, or production[1] was selected based on interviews with industry representatives and government officials. These estimates have been used throughout this report as an "expected" level of production, which may or may not become an actual fact.

During Phase II, several "levels of production" for these energy projects will be analyzed separately for their impacts on the transportation system and subsequent economic, environmental, and other types of impacts. In most cases, this will result in high and low estimates of production levels, with the expected level somewhere in between.

For example, this report describes coal exports in the six to ten-million-tons-per year range. The recently announced contract between the State Ports Authority and the Alla-Ohio Coal Company was for three million tons per year. This would obviously be the "low level of production" for this energy project. The "high level of production" for coal would be derived from a complex set of capacity computations involving possible coal terminal sites available, acreage, rail capacity, and collier (coal ship) accessability. This upper limit has recently been estimated by the State Ports Authority at approximately 80 million tons annually.

Similarly, this Phase I report covers needs projected for the transportation system that are based on the expected level of production for the energy projects, and the most obvious or currently planned mode of transport. A further discussion of how the Phase II study will deal with alternate modes of transportation is included in Section 3.2 on Transport Needs Projections.

---

[1]The term "level of production" will be used in a generic sense to denote several different meanings.

Literature on OCS-related projects generally refers to the "recovery" of specified, estimated quantities of oil or gas. This concept of resource recovery would also apply to wood and peat. In the case of other energy-related projects, this quantity measurement will apply to the processing, production, storage, or transport of an energy feed stock or product.

1.2 Scope and Objectives

One of the most important questions regarding OCS development, as well as with other energy-related projects in the coastal zone, is the formulation of a transportation development strategy by state and local planners and policy-makers.[1] In order for planners in this state to have available sufficient information on which to make rational decisions concerning the role of transportation and other key facilities, and to have an understanding of their interaction with each other, this project was designed for the overall purpose of assessing the potential impacts of future transportation and terminal area infrastructure investments on the North Carolina coastal zone.

As indicated in Section 1.1, this project is divided into two distinct phases. The objectives of Phase I of the study are:

1) To identify and document key facilities, projects and activities in the coastal zone (either planned or under development) that are related to the generation, use, or transmission of any form of energy;
2) To identify and document key facilities that are a part of the transportation infrastructure and may be used for transporting personnel or for the movement of energy feed stocks and products to and from the energy facilities identified under Objective 1;
3) To identify and document a complete set of potential impacts (economic, social, demographic, fiscal, recreational, and environmental) resulting from the use of alternate transportation modes for transporting OCS oil and gas;
4) To identify and document potential recreational and environmental impacts resulting from the use of alternate transportation modes for transporting all other energy commodities, including coal, refinery products, peat, and other onshore energy feed stocks and products.

These four objectives have been addressed in this Phase I effort and are the subject of this report.

---

[1] "Onshore Impacts of Offshore Oil: A User's Guide to Assessment Methods", U.S. Department of Interior, Washington, DC, May 1979.

The work completed during Phase I to accomplish the third and fourth objectives outlined above has resulted in a study design for the Phase II effort, to be undertaken during 1981 and 1982. The objectives of Phase II are:

1) To develop a complete data set of impact indicators identified and documented in Phase I, using 1980 census data and other secondary data sources;
2) To document for the state, coastal region, localities and industries involved in OCS activities, the advantages and disadvantages of locating an OCS support base at one or more sites in North Carolina;
3) To monitor near-term[1] changes observed in transportation infrastructure investments in the coastal zone for the purpose of forestalling mitigation procedures;
4) To monitor near-term changes in social, economic, recreational and environmental impacts of alternate transportation modes for shipping energy feed stocks and products;
5) To project long-term transportation infrastructure investments (ports, highways, rail, truck, pipeline, and waterborne commerce) needed to support energy-related projects and to analyze potential social, economic, recreational and environmental impacts of these transportation investments.

1.3 Definition of Study Area

The study area examined in this project includes the twenty counties in the Coastal Zone Management Area, as defined by the Federal Coastal Zone Management Act of 1972 (PL 92-583), and the North Carolina Coastal Area Management Act of 1974 (CAMA). These 20 counties are: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington. These counties were specified in Executive Order No. 5, issued April 29, 1974, in response to the requirements of CAMA. Programs and projects in these 20 counties come under the jurisdiction of the Coastal Resources Commission and the Coastal Management Office of the State Department of Natural Resources and Community Development (DNRCD), two entities set up by the CAMA legislation.

---

[1]Near-term changes are those observed from the time baseline data are collected during Phase I until the end of Phase II, a period of almost three years. Long-term changes would extend beyond the 3-year project period for 10-20 years.

In addition to the twenty counties in the Coastal Zone Management Area, the study team chose to include an additional seven counties: Bladen, Columbus, Duplin, Jones, Lenoir, Martin and Pitt. The reasons for inclusion of these additional, contiguous counties are: (1) several energy-related projects identified during the study are in these counties; (2) several major rail and highway corridors which serve the coastal zone pass through these counties; (3) several airports located in these counties serve the coastal zone; and (4) the impacts in these seven counties may be as important to the overall growth of Eastern North Carolina as the impacts of projects in the Coastal Zone Management Area itself.

Figure 1-1 shows the twenty-county Coastal Zone Management Area and the seven-county extension "second tier" that together make up the study area included in this project. All 27 counties are part of the Coastal Plains Region of North Carolina. The Coastal Plains Region is that area in Eastern North Carolina that is eligible for projects and assistance from the Coastal Plains Regional Commission. The counties included in the Coastal Plains region which constitute the western boundary of the region are Halifax, Harnett, Hoke, Johnson, Nash, Northampton, and Scotland (Figure 1-2).

In this project report, the 27 counties identified above and in Figure 1-1 will be referred to as either the "study area", or the "coastal study area". These terms will be used interchangeably. The term "coastal plain", on the other hand, will refer to the entire 41-county area under the auspices of the Coastal Plains Regional Commission.

1.4 Procedure for Identifying Energy Projects

A series of interviews was held with local and state government officials, and with representatives of industries associated with either energy or transportation projects in the study area. These interviews and meetings were the major sources of information regarding the projects which are discussed in Chapter 2.

The majority of the interviews were held with only one or two persons of the agency or firm. These were usually informal meetings in which members of the study team described the study and the type of information being

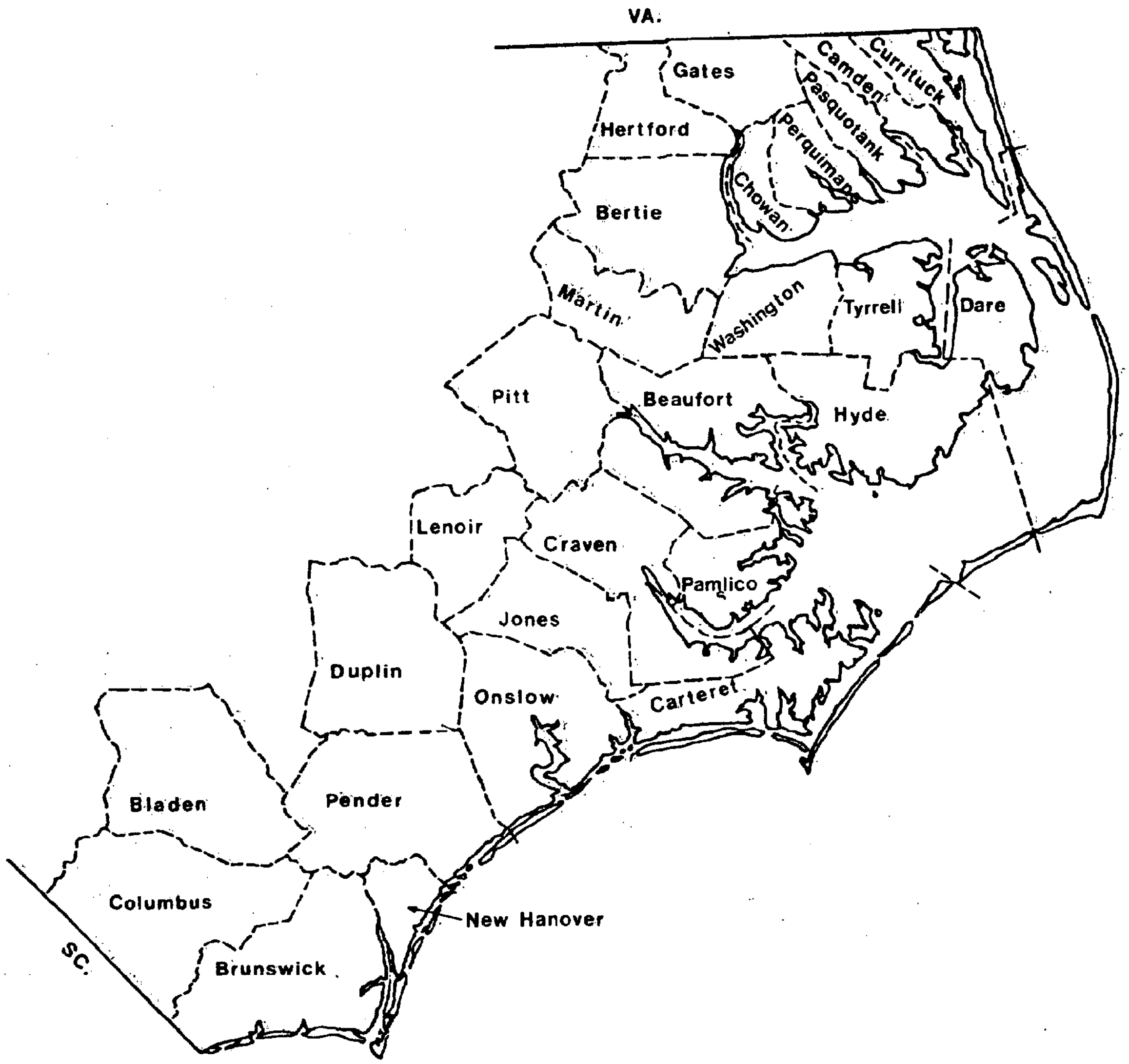


FIGURE 1-1

THE COASTAL STUDY AREA

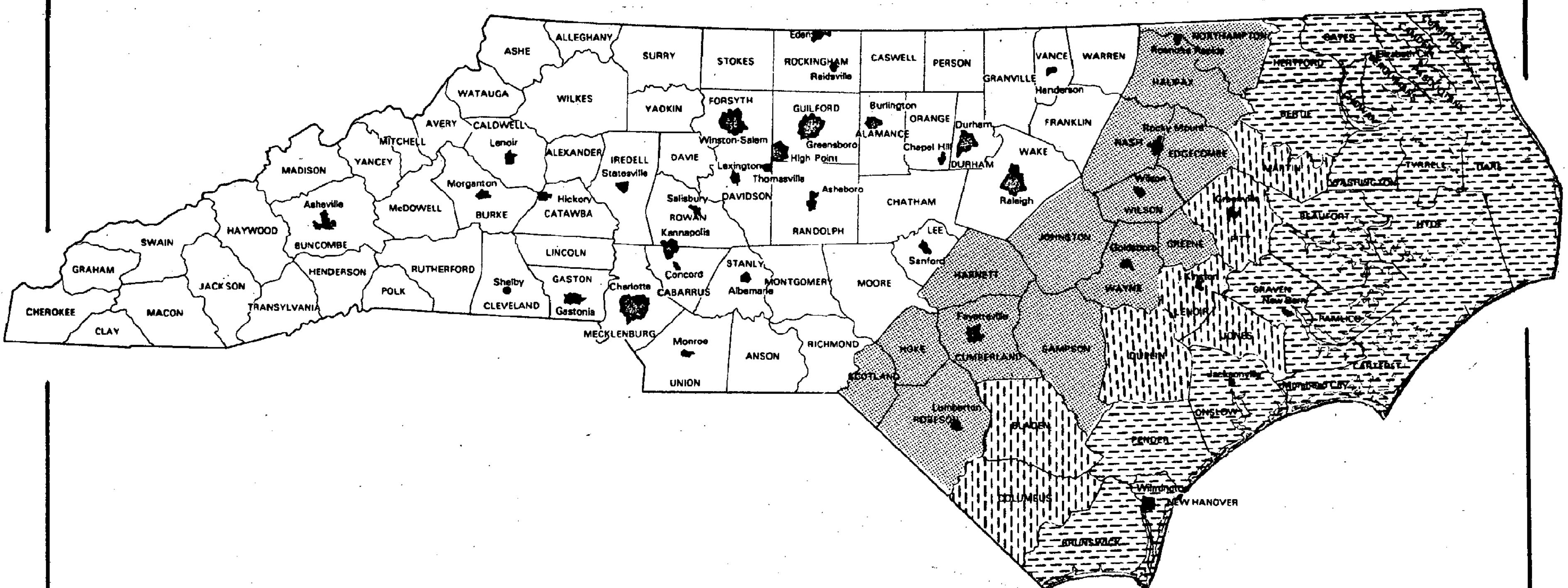


FIGURE 1-2

COASTAL AREAS OF NORTH CAROLINA

Coastal Plains Region (remainder)

Coastal Zone Management Area

Additional Counties Included in the Study Area sought, then discussed any information that was offered by the agency or industry. These meetings were most helpful in determining levels of energy production, transportation requirements and economic impacts expected for the projects under investigation.

Two meetings were held in which a more formal presentation was made before larger audiences, groups composed of individuals from many varied organizations. The first of these meetings was held in Raleigh on May 22, with 24 people in attendance. The second meeting was on May 28 in Wilmington, with five local leaders and planners in attendance. These meetings proved very effective in conveying the concerns of those present in the areas of transportation, energy, environmental protection, and growth and development. The Raleigh meeting was for representatives of many state agencies concerned with the topics of energy, transportation and coastal management. The Wilmington meeting was helpful in allowing local planners and decision-makers to express their concerns, especially with regard to several projects with which they are currently concerned.

Appendix A.1 is the listing of the people who were interviewed or attended one of the meetings discussed above. In subsequent meetings w.th state and local government and industrial representatives, an Advisory Committee was formed to review output of the study at key project mileposts. A list of the Advisory Committee members is shown in Appendix A.2. This Committee reviewed and provided comments to the Study Team during October 1980.

1.5 Identification of Energy Projects

The overall purpose of this project is to analyze the various transportation modes associated with energy development in the coastal zone of North Carolina, and the impact of transportation development and operation on the social, economic, recreational and environmental infrastructures of the area. Therefore, energy projects or activities must first be identified to develop the scenarios necessary to examine levels of transportation activity.

Many energy projects are in various stages of development: applications for necessary permits have already been submitted for some projects; feasibility studies are still needed for others. Many of the projects have had very little publicity, especially those which have sensitive and/or proprietary negotiations still in progress. Private developers of projects have, understandably, taken a position of releasing only limited information to prevent any public opposition of the developments based on false or preliminary information which may be misinterpreted by groups not familiar with the requirements of the activity. Other projects have been widely publicized and subjected to public attention through the news media. Because of the difference in levels of development and the limited scope of this report, it becomes necessary to limit the depth of investigation into these many activities.

The classification of a project as either "major" or "minor" (Chapter 2) is based on several factors, with no specific levels set as limits on these factors. Estimated levels of transportation impacts, energy production (or consumption, as the case may be), employment levels, and even the availability of information concerning a project were the major criteria used for the classification. While appearing somewhat arbitrary, it is believed that the "major" projects identified in Table 1-1, as a group, will have significantly greater impacts on the study area than the "minor" projects. However, it should not be inferred that these impacts are all adverse. Some levels of development in certain areas within the study area may lead to increased levels of services, such as natural gas pipelines and rail facilities, severely lacking in parts of the study area, which could lead to the controlled development required to improve the standard of living in the region.

A brief description of each major project is presented in Chapter 2, followed by a summary of all the minor projects which were encountered in a review of available literature or in the local interview process. In Phase II of this study, the impacts of transportation facilities that support the major energy projects identified in Table 2-1 will be addressed. From time to time, however, it is fully anticipated that the list of major projects will change due to changing economic conditions or other factors.

TABLE 1-1

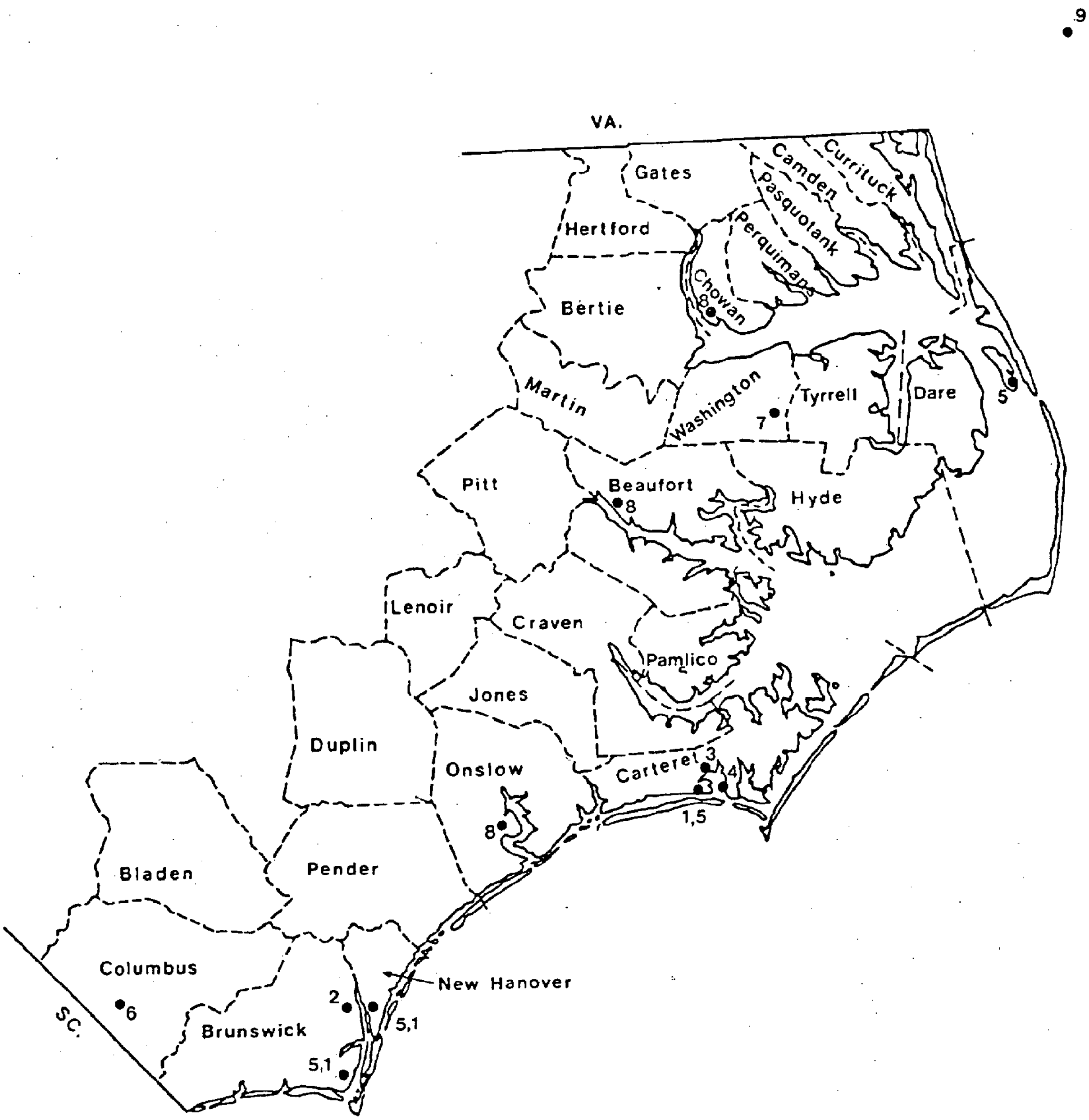
ENERGY PROJECTS AND ACTIVITIES IN THE COASTAL STUDY AREA

A. Major Projects (See Figure 1-3)

1. Coal Exportation through North Carolina Ports
2. BECO Refinery - Brunswick County
3. CRDC Refinery - Morehead City
4. LPG Terminal - Radio Island at Morehead City
5. OCS Support Bases - 14 sites at four locations
6. Aluminum Processing Plant - Columbus County
7. Peat-Fired Electric Power Generation & Process Heat
8. Wood-Fired Electric Power Generation & Process Heat
9. Virginia Supertanker Port Complex

B. Minor Projects (not located on Figure 1-3)

1. Municipal Wastes of Wilmington/New Hanover County to Horry County, S.C. for Electric Power Generation
2. Municipal Solid Waste Gasification (various locations)
3. Low-Head Hydro Power from Canal Locks on Upper Cape Fear near Fayetteville
4. Wood Chip Exportation from N.C. Ports to Europe/Scandinavia
5. Plastics Plant in Grimesland/Pactolus Area, Pitt County
6. National Spinning Company Waste-Fired Steam Plant, Beaufort County
7. Gasohol Production Projects
8. Swine/Chicken Manure Methanization Projects
9. Wind, Solar and Geothermal Projects
10. Expansion of Existing Energy Production or Distribution Facilities



6● Numbers refer to major projects listed in Table 1-1.

FIGURE 1-3
LOCATION MAP OF MAJOR ENERGY PROJECTS

2.0 DESCRIPTION OF ENERGY PROJECTS

In an effort to estimate the future transportation impacts of the proposed energy projects, each of the nine major projects identified in Chapter 1 was reviewed individually. Based upon the best information available on 1 July 1980, energy use scenarios identified as the "most probable" operating conditions for each project are developed in the following sections.

2.1 BECO Refinery - Brunswick County

The Brunswick Energy Company (BECO) is a joint venture to build an oil refinery on a 1,900-acre site in Brunswick County just west of the confluence of the Brunswick and Cape Fear Rivers. High-sulphur, heavy crude oil that cannot be processed by the majority of existing refineries will be imported. The utilization of new techniques such as hydrogen cracking, catalytic reforming and flexicoking is anticipated at the site.

The refinery is projected to cost $750,000,000. The peak construction work force is estimated to be around 3,000 with permanent employees numbering 350. Construction is expected to start in 1981 or 1982 and take three years to complete.

Backgrounds of the participants in the Brunswick Energy Company (Crown Central Petroleum - 52½ %, Stewart Petroleum - 32½ %, and Federal Paper Board - 15%) reflect the probable operating policies of the proposed refinery. Crown Central Petroleum Corporation, a Baltimore-based producer, marketer, and refiner of petroleum products, with annual sales of more than $1 billion, imported 75% of its crude oil in 1979 - mostly from Nigeria.[1]

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[1] Barrons, June 23, 1980; P. 32.

The heart of Crown's physical properties is its 100,000 barrel-per-day (BPD) refinery in Houston. Approximately 40% of its production is sold through the firm's gas stations along the East Coast; the remainder is wholesaled. Stewart Petroleum Company is an independent terminal operator and fuel oil marketer in the Washington, D.C. area, with a 250-million-gallon terminal located on the Potomac River at Piney Point, Maryland. Federal Paper Board is a major paper producer and manufacturer of cartons and other wood products with a plant at Riegelwood, North Carolina.

Because no new refineries have been built on the East Coast in 25 years, the 150,000 BPD refinery in Brunswick County represents a unique opportunity to implement new processing technology and more environmentally acceptable procedures. As planned, crude oil will most likely be imported from Saudi Arabia, Venezuela and Mexico, with some transhipped from a Burmah Oil Company terminal in the Bahamas. On the average, three 50,000 deadweight-ton (DWT) tankers per week will enter the Cape Fear River and dock on the east side of the river at a T-head in the vicinity of the Exxon Terminal (See Figure 2-1). Crude oil would then be transferred to the storage area by means of a pipeline under the riverbed.

According to a recent interview,[2] the expected refinery output of 141,000 BPD will include unleaded and leaded gasoline, diesel oil, kerosene, home and industrial heating oil, propane, butane and jet fuel. This output will be distributed by highway, water and rail to a market area as far as 500 miles away (Jacksonville, Florida to New York City). The most conservative scenario envisions the following modal distribution of refinery products:

76%	130 ships or seagoing barges (avg. capacity = 100,000 bbl. per year)
	425 barges (avg. capacity = 40,000-60,000 bbl. per yr.) on Atlantic Intracoastal Waterway (AIWW)
18%	140 trucks per day (from Wilmington area)
6%	20 railroad cars per day
100%	

[2]Interview on 19 June 1980, with Mr. Richard W. Ricks, BECO Manager of Finance and Administration, Leland, N.C.

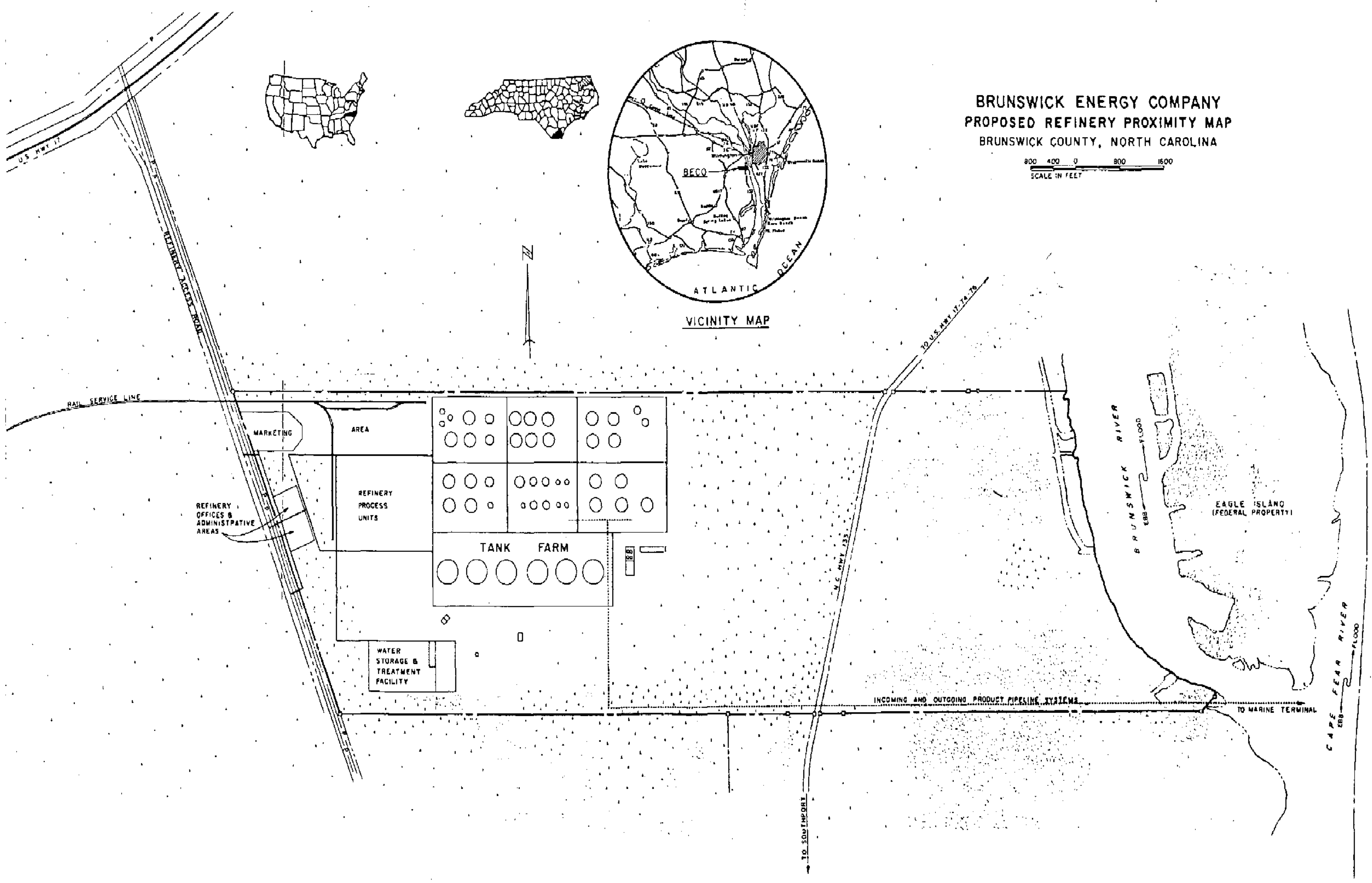

BRUNSWICK ENERGY COMPANY
PROPOSED REFINERY PROXIMITY MAP
BRUNSWICK COUNTY, NORTH CAROLINA
800 400 0 800 1600
SCALE IN FEET
VICINITY MAP
ATLANTIC OCEAN
BECO
N
U.S. HWY 17
REFINERY ACCESS ROAD
RAIL SERVICE LINE
MARKETING
AREA
REFINERY PROCESS UNITS
REFINERY OFFICES & ADMINISTRATIVE AREAS
TANK FARM
WATER STORAGE & TREATMENT FACILITY
TO U.S. HWY 17-74-76
N.C. HWY 133
TO SOUTHPORT
INCOMING AND OUTGOING PRODUCT PIPELINE SYSTEMS
TO MARINE TERMINAL
BRUNSWICK RIVER
EBB
FLOOD
EAGLE ISLAND (FEDERAL PROPERTY)
CAPE FEAR RIVER

FIGURE 2-1

2.2 CRDC Refinery - Morehead City

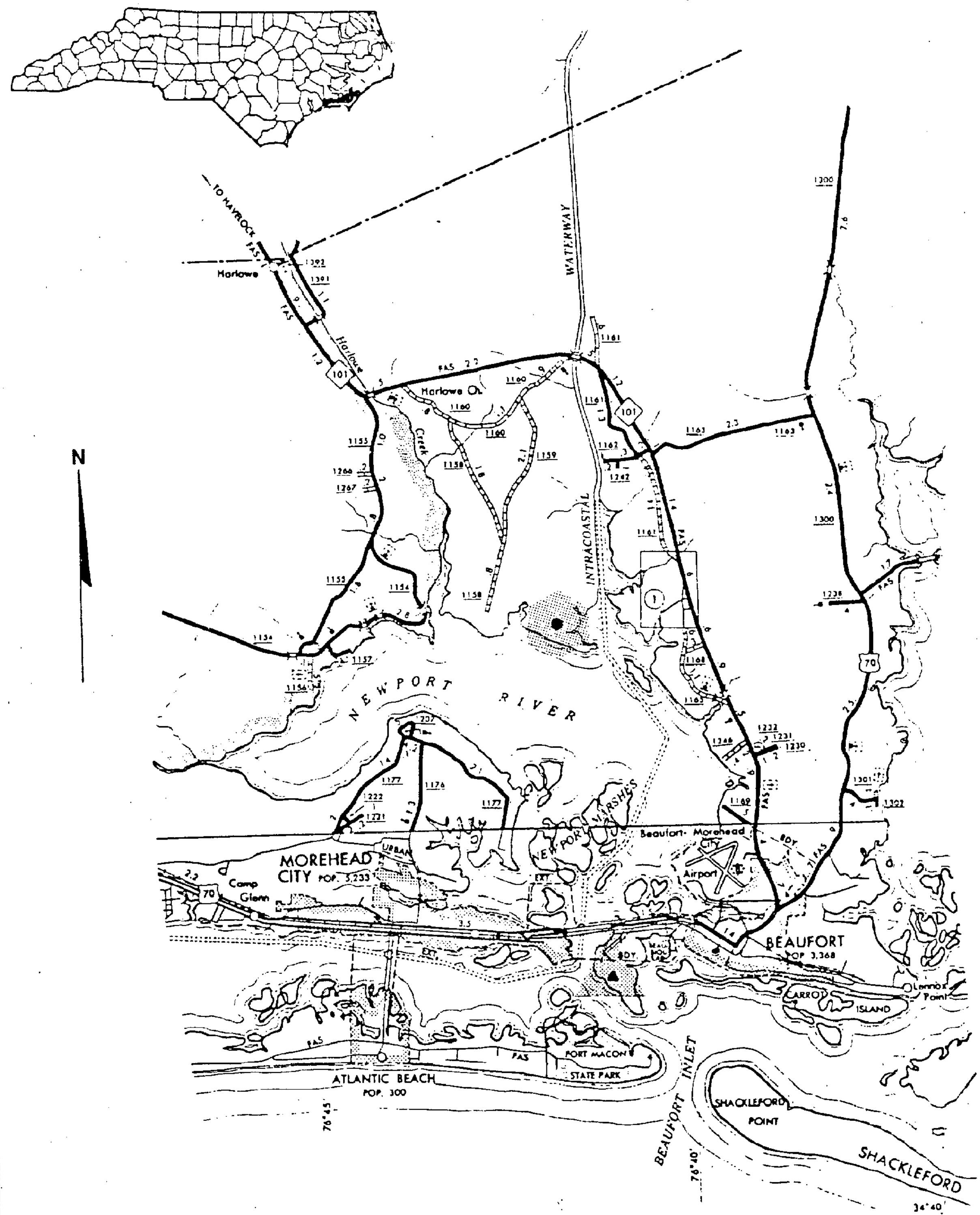
As one of four South Atlantic refineries currently being planned by the Carolina Refining and Distributing Company (CRDC), the proposed refinery on the Newport River near Morehead City requires special consideration. CRDC has indicated that it also plans a 30,000 BPD refinery near the Sampit River at Georgetown, S.C. and smaller facilities in Savannah, GA and Fort Pierce, FL.

The relatively small capacity of the refinery reflects a decision to produce commodities that will be locally consumed. The primary products to be produced include: No. 2 fuel oil (15,600 bbl/day); 90 Octane unleaded gasoline (11,250 bbl/day); and kerosene (1,600 bbl/day), with the balance of production in propane and with petroleum coke and sulphur as marketable by-products. High-sulphur crude oil will be the primary feedstock, thus requiring a desulphurization process which will yield approximately 36 tons of sulphur per day.

The estimated cost of construction of the facilities is on the order of $100 million, with the estimated market value of the refinery products exceeding $220 million per year.

The refinery would utilize high sulphur crude oil imported from Venezuela or Mexico by tanker. One 40,000 DWT vessel per week would discharge at an existing T-head pier located at the North Carolina State Ports Authority Terminal. Refinery feedstock would then be transferred approximately four miles by pipeline to the tank farm at the refinery site on the Newport River. (See Figure 2-2.) Major products to be produced would be unleaded gasoline, kerosene, No. 2 fuel oil and propane. Refined products would most likely be distributed by barge or truck.

While no market data were available, it appears reasonable to assume that, since the refinery was sized to market refined products in the immediate area, most of the output will move by truck. Furthermore, because of



● Refinery site

▲ LPG Terminal site

FIGURE 2-2
CRDC REFINERY AND LPG TERMINAL

anticipated competition from larger refineries planned for Wilmington (BECO) and Portsmouth, VA (a 175,000 BPD refinery on the Elizabeth River has been proposed by the Hampton Roads Energy Company), significant outbound movements by barge or ship are not anticipated. Project personnel estimate that 70% of the refined products will move by truck (110 trucks per day) while the remaining 30% will move by barge (60 barges per year) on the Intracoastal Waterway.

2.3 LPG Terminal - Radio Island

One of the nation's most versatile sources of energy, liquified petroleum gas (LPG), is stored and transported as a liquid under moderate pressure. According to recent estimates reported in the "Carolina LPGas News", more than 16 billion gallons of LPG are presently being consumed each year in the U.S. North Carolina's consumption of 96.7 million gallons is almost entirely for residential use.

A 21-million-gallon bulk storage terminal for LPG has been proposed at a location on Radio Island. Gulf Interstate Company has owned the land (See Figure 2-2 for site location), on a 77-acre tract of Radio Island, since 1973. While no precise estimates of throughput are yet available, it is anticipated that approximately 30 tankers per year (average DWT = 40,000) would deliver LPG to the terminal where it would be placed in storage tanks for subsequent delivery north and west of Morehead City by truck or rail. LPG must be handled and stored cryogenically at a temperature of approximately -44^{o}F (-42 C). The construction cost of the facility has been estimated to be approximately $25 million.

The State Energy Management Plan for North Carolina, prepared in 1974 by the Research Triangle Institute and the Office of State Planning, estimates that LPG use in the state will double by 1990. No current estimates are available.

Nevertheless, the project has been delayed indefinitely because of the world market conditions for LPG. In addition, some aspects of this facility have met with local opposition, especially with regard to fire, explosion and environmental degradation.

Competition for the LPG market in the Coastal Study Area currently is provided by a marine terminal at Chesapeake, VA and a pipeline terminal at Apex, N.C. Distribution from these sites is primarily by truck and it is expected that 85% (110 trucks per day) of the LPG distributed from Radio Island will be by truck and the remaining 15% (10 rail cars per day) by rail.

2.4 Aluminum Smelter - Columbus County

Until December 1980, an aluminum smelting plant was planned for an 11,400-acre tract near Tabor City in Columbus County. The $400 million smelter was proposed by Coastal Aluminum Group of North Carolina, Inc., Initially scheduled for ground breaking early in 1981, permits have been held up and the current status of the project is uncertain. Coastal Aluminum is also planning a smelter in Marlboro County, South Carolina.

Although this project is not an energy producer or an energy feedstock operation, aluminum processing is very energy-intensive. For this reason, and because of its major impacts on the transportation systems in southeastern North Carolina's coastal zone, it is included in this report.

Figure 2-3 shows the proposed plant on a 250-acre site surrounded by a buffer zone and located between N.C. Highway 904 and Clarendon in the area between Tabor City, Chadbourn and Fair Bluff. Raw materials in the form of alumina and coke would be imported by ship at Wilmington and then moved by rail to Columbus County. Shipments of alumina would originate in Australia, Surinam, Jamaica, and possibly Ireland and would be discharged at the State Ports Authority facilities in Wilmington, where the alumina would be stored in a 120,000-ton silo to await rail transshipment.

It is anticipated that 400,000 tons of alumina and 100,000 tons of petroleum coke would be imported in dry bulk ships averaging 40,000 DWT each (one ship every four weeks). An average of 16 rail cars per day would then be needed to transfer alumina from the storage silos to the smelting plant. Approximately 200,000 tons annually of finished aluminum products would returned to the port by rail or truck for distribution by ship. An average

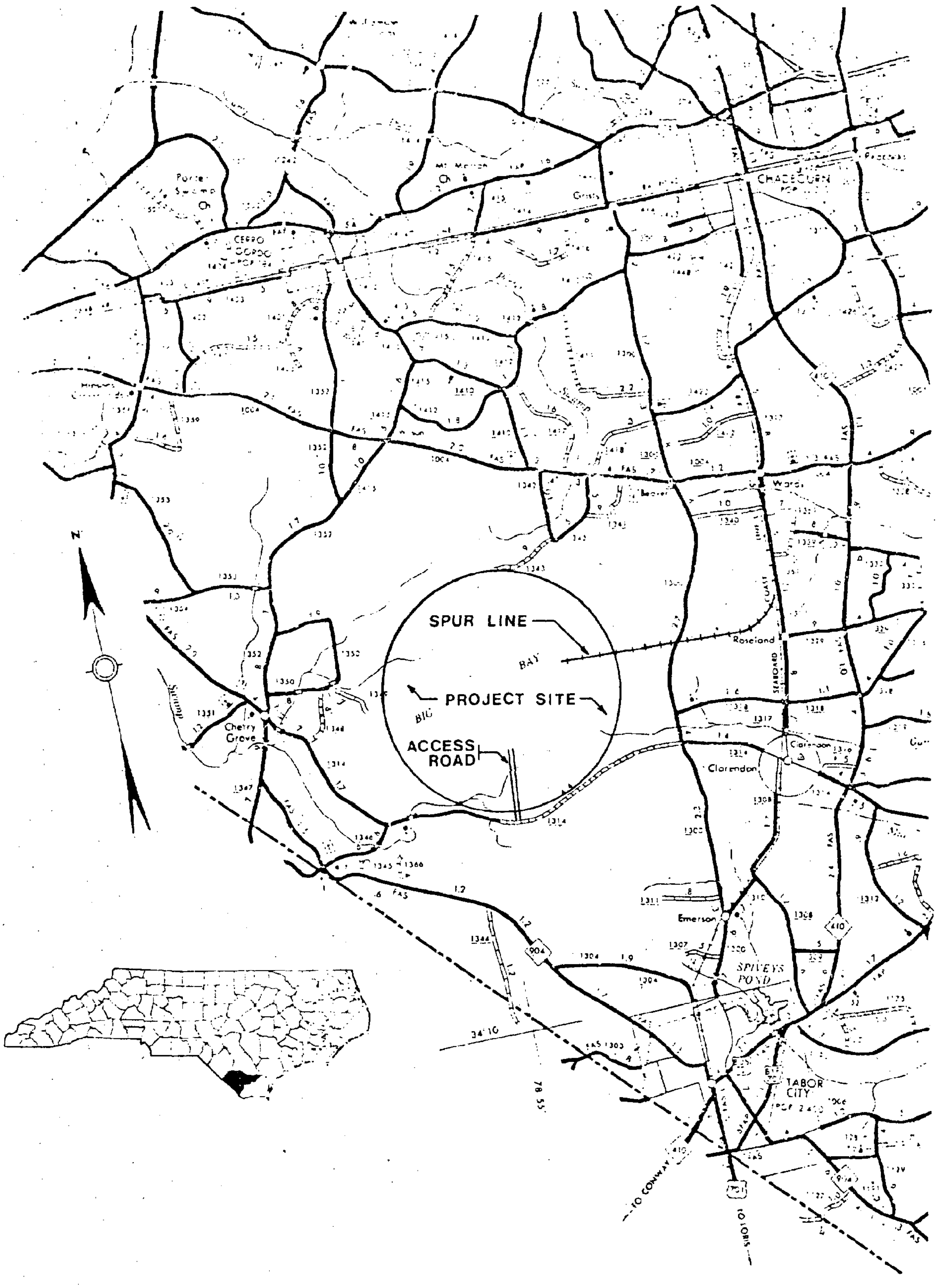


FIGURE 2-3

ALUMINUM PROCESSING PLANT

of six rail cars or 16 trucks per day could handle this movement.

During the first phase of the construction period when employment is expected to peak at 2,000 workers, 240 rail cars and 640 trucks will be utilized in the construction area. About 18 months later, when construction of additional buildings begins, an additional 245 trucks and 60 rail cars will be needed.

Energy requirements for the processing of alumina are substantial. Discussions with officials of Carolina Power & Light Company (CP&L) and Coastal Aluminum Group indicate that 325 megawatts (MW) of electricity per day will be required and that CP&L has adequate generating capacity to fulfill these requirements.

2.5 Peat Projects - First Colony Farms, Washington County

First Colony Farms, Inc. (FCF), a corporate farm development primarily interested in agricultural activities, owns about 372,000 acres of land in Washington, Tyrell, Dare and Hyde Counties. This land contains approximately 146,000 acres of fuel grade peat which, when extracted to depths of 4 to 6 feet, is estimated to contain 203 million moisture-free tons of peat. Plans for four 150-MW generation units to be constructed over a six-to eight-year period have been discussed. In meetings with First Colony Farm officials, it was determined that the first generating unit could be on line within two and one-half years from the start of construction. Each generation unit will have an average annual peat consumption of 1.126 million short tons, with the peat at 50 percent moisture and having a heat value of 5,000 BTU per pound.

At this time, no date has been set for the beginning of construction of the first unit. There must be a cooperative effort on the part of First Colony Farms, as the fuel supplier, and a power company or an electric membership cooperative (EMC) as the owner/operator of the facility, to ensure the satisfactory operation of such a facility.

First Colony Farms management indicated that there will be little impact on the public transportation systems of the area. In order to minimize haul distance, peat would be moved on a privately-owned internal network from the peat fields to the power plant, which would be located at the approximate centroid of the peat deposits. The plant location also has severe requirements for adequate cooling water supplies, bearing capacity of the soils and environmental considerations.

Other possible uses of peat as an energy source include the production of methanol and/or synthetic natural gas, and the production of process heat, either as dry heat, steam, or water heating. The use of peat for producing methanol and synthetic natural gas is being investigated because the chemical composition of peat is such that it may be better for this purpose than coal.

As a fuel for process heating, peat could be supplied economically to industries within a 75-mile radius of the peat deposits. First Colony Farms is currently negotiating with several industries, including Weyerhauser at Plymouth, Texasgulf at Aurora, CF Industries on the Chowan River and Union Camp Paper Company in Franklin, Virginia. Gay and Paisley (1979) have investigated the possible use of peat for firing bricks.

These possible uses of peat as an energy source have been suggested:

1) Methanol Production
2) Process Heat Production
3) Peat-Fired Electricity Generation

Methanol production is the activity for which the most data relative to production and peat consumption are available. Production of 500 tons per day of methanol would require 4,300 to 5,700 tons per day of peat. A plant of this size could be on-line within 3 years. The next level of production would be 2,500 tons per day of methanol; a plant of this scale might be feasible by the year 2000. A full-scale methanol plant would produce 5,000 tons per day. At this production level, approximately 50,000 tons per day of peat would be required.

Natural gas is the currently-used feedstock for the production of methanol. With the impending deregulation of natural gas pricing in 1985, either coal or peat may become the predominant feedstock for methanol. The recently passed federal synthetic fuels legislation could prove very important in the development of peat resources in North Carolina.

Using the same rationale for locating the methanol plant as the electric generation plant, it is expected that a transportation network of either conveyors or railroads will transport the peat to the plant site, this site being at the approximate centroid of the peat deposits. This location also must be compatible for water quality and supply needs and must have suitable soil characteristics to support the plant structure. It is anticipated that the peat transport system will be completely separate from any existing highway and/or rail system.

The use of peat to replace or to supplement currently-used fuels for process heat requirements of industries is the activity which most likely would have the greatest impact on the transportation system. Peat could be used to replace wood chips as a fuel, especially as wood chips become more valuable for other uses in the wood, pulp and paper industries. Peat can also be blended with coal to produce a fuel. This could be cost-effective for large coal users, such as electric utilities, especially where the difference in costs of the fuels and transportation makes it worthwhile to install the necessary handling and blending equipment.

There has been some discussion of developing a peat-and-oil slurry for use in oil-fired boilers and at power plants. Because of oil's higher price, replacing oil with a peat/oil mixture would be more economically attractive than replacing coal with a peat/coal mixture. The possibility of a peat and methanol slurry for use as a fuel is most promising in light of the peat-to-methanol conversion potential.

Although peat-fired electric power generation appears to be eight to ten years in the future, a recent announcement[3] indicated that the U.S. Senate

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[3] Raleigh News and Observer , August 1, 1980.

had approved $3.1 million for first-stage design and engineering of a solid peat electric generating plant that may be located in Eastern North Carolina. Preliminary reports concerning the feasibility of a peat-fired plant have been prepared for First Colony Farms, Inc. by several consultants. A 600 MW generating station could be built in four phases, adding one 150 MW unit in each phase. Each of these units would use approximately 1.13 million tons of peat/year. The plant would be located at the approximate centroid of the First Colony Farms' peat deposits, with all the peat moving to the plant site on a private rail or conveyor system.

Coal has a heat value of about 13,000 BTU/lb. With peat at a 50% moisture content, heat values range from 5,000 BTU/lb. to as high as 9,000 BTU/lb. About two pounds of peat are required to replace one pound of coal for fuel purposes. The increased weight and bulk of the peat result in higher transportation costs per unit of energy. Thus, 77 pounds of coal would be required to produce 1 million BTU's, while it would take 154 pounds of peat to produce an equal amount of energy. Therefore, to be competitive, peat would have to be available at the site at a price, including transportation costs, roughly half that of coal delivered to the site.

Because of the proprietary nature of the negotiations between First Colony Farms and several industries which may become buyers of peat as a fuel, it is difficult to estimate the level of production and the market for peat within the near future, but some FCF officials believe that peat can compete with coal within a 60-mile radius of their operation in Washington County.

There are presently no rail facilities in the peat areas which could accommodate the transport of peat to inland markets. FCF anticipates that barge tows could serve as the primary transport mode from their Pamlimarle deposits (Figure 2-4). This is a result of the relatively low transportation costs associated with barging, the extensive navigable waters between the peat deposits and the possible consumers, and FCF's land along the Alligator River where they plan to construct barge terminals and loading facilities.

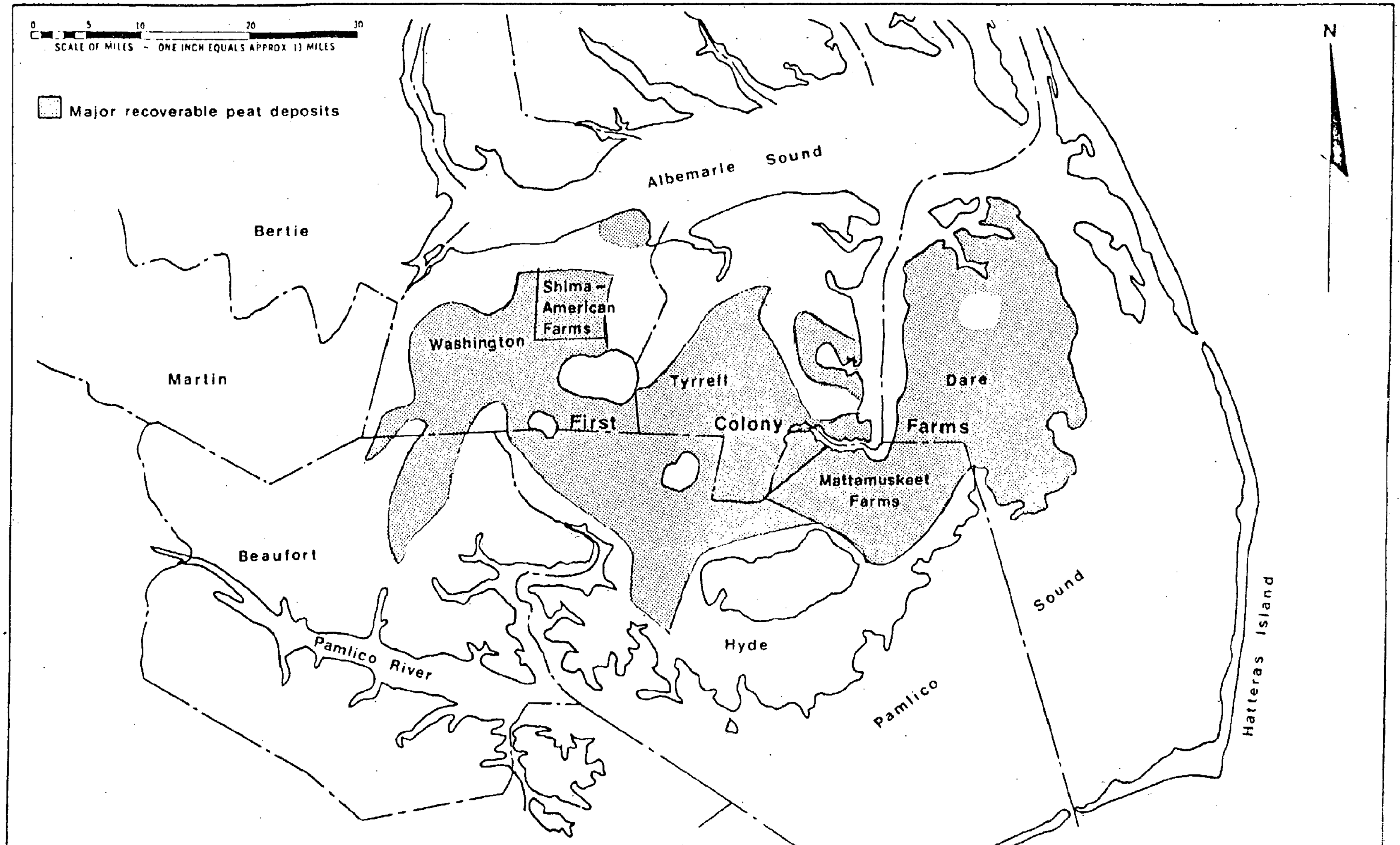

FIGURE 2-4

PAMLIMARLE PEAT DEPOSITS

Four scenarios relating to impacts on the transportation infrastructure need to be investigated. These are associated with low, medium and high levels of peat output as well as the case where there is no development of peat resources beyond current levels. The four scenarios are developed here with associated transportation requirements following in Chapter 3.

Currently, First Colony Farms is producing approximately 2,000 tons of peat per week, primarily during clearing operations where land is being prepared for agricultural purposes. This level of production will remain constant if none of the activities that might provide additional markets for the peat are undertaken.

A low level of peat production would result from the first phase of either a methanol production plant, one 150 MW electric generation unit, or a large industrial client purchasing peat for process heat purposes. The methanol plant and the electric generating station would not require transportation of peat outside of First Colony's property. A small industrial buyer could purchase as much as five barge loads per week, assuming 400 tons of peat per barge.

For a medium level of peat output to be attained, a combination of the various projects just mentioned could be developed. Some of the possible combinations would be: (1) two or three 150 MW electric generation units; (2) a 2,500 -ton -per-day methanol plant; (3) several large industrial customers purchasing peat for process heat fuel; or (4) one 150 MW electric unit, a 500-ton-per-day methanol plant, and some industrial consumption. As in the low-level-production scenario, all peat movement for electric generation and methanol production would be internal to First Colony's property. Peat for industrial process heat would require between ten and fifteen barges per week, originating at a barge terminal on the Atlantic Intracoastal Waterway or the Alligator River.

The high production scenario would depend upon either the full 600 MW electric plant or the 5,000-ton -per-day methanol production being fully developed and on-line. Also, there is a possibility that intermediate levels of each of these two activities could occur simultaneously. Under this scenario, an estimated 20 to 25 barges per week of peat would be shipped to industrial customers.

In all cases, the major impact of peat activities on the transportation system of the Coastal Study Area would be increased barge traffic on the Atlantic Intracoastal Waterway. Even in the high production scenario, an estimated 25 barges per week would reduce to four per day, most likely moved in a single tow and causing no severe capacity problems on the Waterway. Thus, there should be little effect on the transportation system as a result of the development of peat resources in Eastern North Carolina.

2.6 Coal Export Terminals

2.6.1 Demand for U.S. Coal

Because coal is the most abundant energy resource in the United States, many observers believe that we must utilize our coal reserves to sustain us in the period between oil dependence and the development of alternative energy resources. U.S. mines produced 770 million tons of steam and metallurgical coal in 1979, but their capacity is estimated to be 100 million tons higher without further capital investment.[4] As added incentive, the Department of Energy's goal is to double coal production between 1978 and 1985. Where the added production will originate and be consumed is vitally important to the nation's transportation system and could be of paramount importance to the Coastal Study Area.

At the Venice Economic Summit in June, 1980, President Carter and the leaders of seven major democratic industrial powers gave renewed emphasis to the importance of coal in our energy future by agreeing to double coal production and use by 1990. Similar pledges were recently made at the Tokyo Economic Summit and by the 20 industrial nations in the International Energy Agency, who agreed to increase their use of coal by converting oil-fired plants and constructing new coal-burning facilities. It has been estimated that a commitment to double coal production could reduce world oil demand by 7.5 to 10 million barrels per day.[5]

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[4] Newsweek, June 30, 1980. "Can Coal Be King Again?"

[5] Wall Street Journal, June 24, 1980.

Coal's abundance and particularly its concentration in the United States where reserves are estimated at 397 billion tons, or 24% of world supply,[6] makes it especially attractive as a petroleum substitute. There is growing evidence that the expanding coal needs of the free world's industrialized and developing nations will create an unprecedented opportunity for American coal on the world market.

Statistics provided by the Bureau of Mines, U.S. Department of Commerce, indicate that the following nations currently lead the world in coal production:

Country	1979 Production Millions Short Tons
U.S.S.R.	820
U.S.A.	740
West Germany	240
Poland	216
United Kingdom	135
Czechoslovakia	120
Australia	110
India	100

Free world coal reserves further emphasize the dominant position of the United States in reducing future shortfalls. Not only does the U.S. have the largest reserves of good quality coal, it also has a very efficient coal mining industry and leads the world in coal export tonnage. American coal exports amounted to 53.5 million tons in 1979 - about 27% of world seaborne supplies.[7] Projections through the end of the century are for a three-to five-fold gain in the world's coal trade from its 1977 level of 200 million tons to between 560 and 980 million tons.[8] Most of that gain, as contrasted

[6] Business Week, June 30, 1980.

[7] Bulk Systems, May, 1980.

[8] Journal of Commerce, July, 1980.

with past years, is expected to be in steam coal rather than metallurgical coal. Until 1979, exports consisted almost entirely of metallurgical coal, with primary destinations being Japan, the European Common Market, Spain and Brazil. Exported steam coal went almost entirely to Canada.

Obviously, with the free world's largest reserves and production capacity, the U.S. is in a position to take a leadership role in fulfilling the agreement reached at the Venice summit. Because the demand for metallurgical coal worldwide is leveling off and competing supplies from Australia, Canada and South Africa are emerging, it is expected that most of the future demand for U.S. exports will be for steam coal. In a recent Department of Energy study, anticipated U.S. steam coal exports to Japan and Northwest Europe (in million tons) were estimated as follows:[1]

Year	Japan	Northwest Europe	Total
1977	0.91	1.81	2.72
1985	3.63	11.79	15.42
1990	9.07	18.14	27.21
1995	18.14	27.22	45.36
2000	27.22	45.36	72.58

Estimates of steam coal export and consumption prepared by other agencies look even more optimistic.

Without doubt, the United States is in a very strong position to make the most of this opportunity. However, many constraints to full-scale conversion to coal, including environmental problems, economic feasibility difficulties and transport capacity limitations, must be resolved. This last constraint, particularly as it regards the port facilities for coal export, is extremely critical. At present, U.S. ports equipped to serve the export coal trade include in descending order of importance: Hampton Roads, Baltimore, Mobile, New Orleans and Philadelphia. East Coast port facilities appear to be operating near capacity with dozens of ships anchored in Hampton Roads waiting to load at the coal piers in Newport News and Norfolk. Furthermore, the Hampton Roads facilities are primarily designed for metallurgical coal and do not operate efficiently for steam coal.

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[9] U.S. Department of Energy, "Coal Exports Study," 1978.

2.6.2 Impact on South Atlantic Ports

Three major markets for exports of Eastern U.S. steam coal are emerging:

- Western Europe
- Japan and Korea
- New England

It appears that significant demand is developing in these areas, and since existing East Coast ports are already operating at capacity, industry and government officials concerned with transporting and exporting Appalachian coal are turning their attention to ports in the South Atlantic range, e.g. Morehead City, Wilmington, Charleston, Savannah, Brunswick and Jacksonville.

There are indications that Brunswick would have to be eliminated as a viable coal port because of limited channel depth (27 feet MLW), and Charleston because of lack of available land. Additional railhaul distance may eliminate Jacksonville as an alternative. This study is concerned only with the two North Carolina ports, although Savannah should be considered as an alternative site.

The rail system serving the Coastal Study Area is discussed in Chapter 3, but it is important here to emphasize the dominant position within the Study Area of two major coal-hauling railroads: the Seaboard Coast Line serving Wilmington, and the Southern, which provides service to Morehead City. Both lines rank among the top five coal-hauling railroads in the U.S., with annual tonnages of 61 million and 43 million tons respectively.[10]

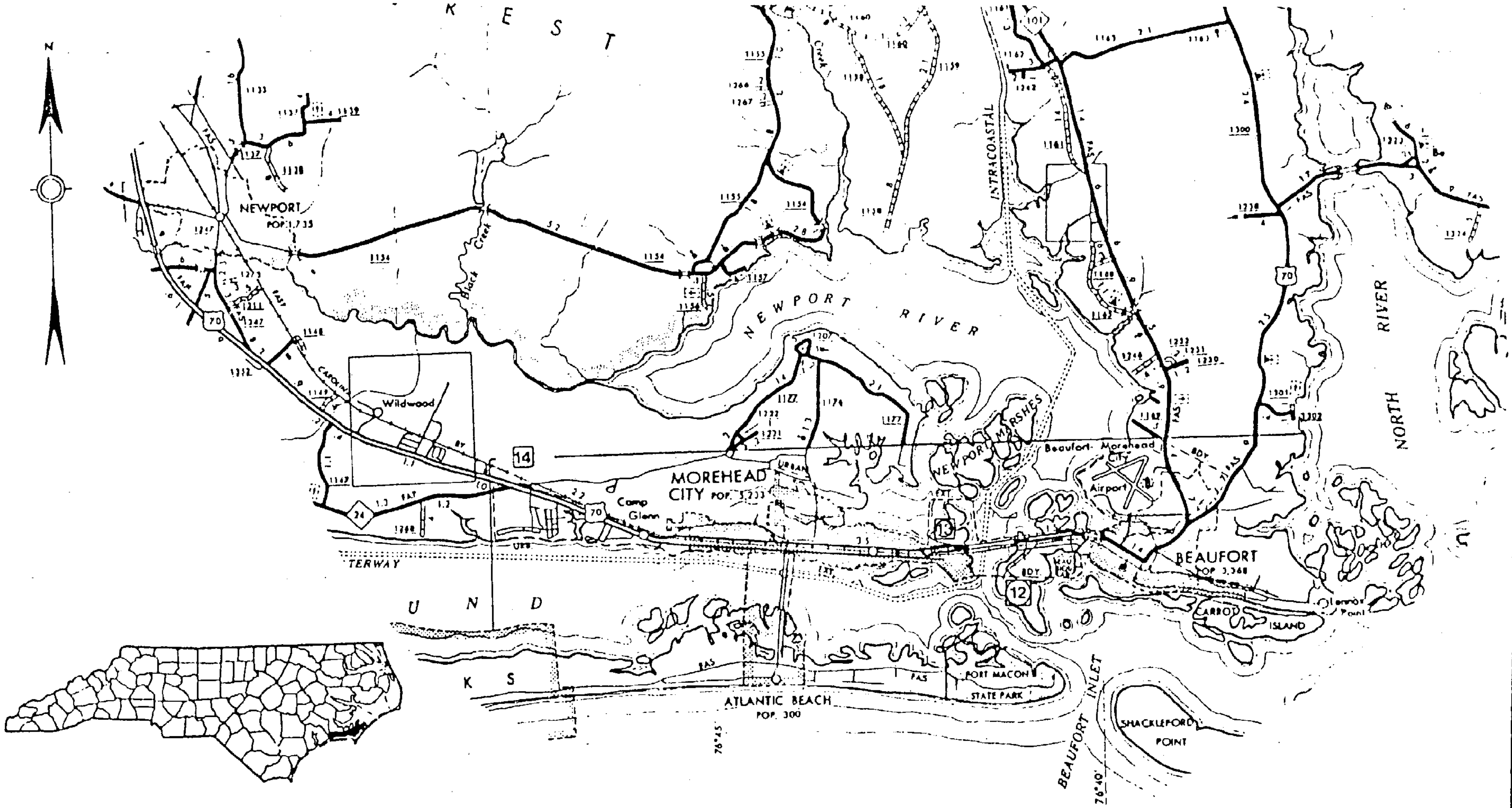
2.6.3 Potential North Carolina Coal Terminals

Morehead City

Three potential sites for a coal export terminal in the Morehead City area are identified in Figure 2-5:

Site	Location	Acreage
C-12	Radio Island	40
C-13	Marsh Island	60
C-14	West of Morehead near junction of US 70 & NC 24	150-300

[10] 1980 Keystone Coal Manual, pp. 251-255. SCL coal is actually hauled by the Louisville and Nashville Railroad, another member of the "Family Lines System."



(Numbers refer to sites listed in Table 2-1)

14 Prospective Coal export terminal sites

12 Prospective Coal export terminal and OCS Support base site

FIGURE 2-5

PROSPECTIVE COAL TERMINAL AND OCS SUPPORT BASE SITES- Morehead City

A throughput of six to ten million tons of coal annually has been assumed for the Morehead terminal utilizing unit trains averaging 100 cars per train. Thus, 100 unit trains of 10,000 tons each would be required annually to move each million tons. For a six-to-million-ton facility, this would necessitate two or three unit trains per day.

Steam coal can be stockpiled in open storage requiring about 50 acres per five million tons. The parcel of land required for a terminal would therefore be at least 100 acres with 200 acres desirable. The existing channel and turning basin depth of 40 feet MLW in the Morehead harbor could accommodate vessels of 60,000 DWT or larger on high tide. The terminal should be above to handle 100-170 bulk carriers (colliers) of this size each year. Loading rates vary but the Curtis Bay (B&ORR) Coal Terminal in Baltimore with a loading capacity of 6,000 net tons per hour[10] seems to represent an average rate. If so, ten hours loading time per collier would be needed at each berth. Theoretically, one berth (1,000 ft. in length) could handle the vessel demand but because of peak loading requirements necessitated by random ship arrivals and the possible need for future expansion, two berths are recommended.

The Radio Island site (C-12) is the same location identified in Figure 2-2 as a potential LPG terminal site. It is owned by the SPA and contains only 40 acres but could be supplemented by 60 acres of land under option and additional nearby storage acreage owned by SPA just north of US 70. Rail shipments of coal would have to move through the center of Morehead City and be transferred into Radio Island over the privately-owned Beaufort and Morehead (B&M) Railroad.

An aerial survey of the 60-acre Marsh Island site (C-13) just north of the phosphate storage area at the SPA has revealed that, in addition to limited size, this site is not on the 40-foot channel and would require dredging and bridge modifications or the construction of a conveyor system to existing deepwater loading facilities at SPA. The problem associated with

[10] Keystone Coal Manual, 1979.

moving several unit trains through Morehead City daily would also have to be faced at this site.

Site C-14 is a 200-acre parcel of land just west of Morehead City and adjacent to the A&ECRR (Southern) at the junction of US 70 and NC 24. This site would eliminate the movement of coal trains through Morehead but would require some form of conveyor belt, slurry pipeline or pneumatic pipeline to transfer coal to the vessel loading facility. This latter facility could be located at the SPA terminal or other pier in the existing port, or it might be developed as an offshore loading facility (Figure 2-5) that could accommodate bulk carriers of 150,000 DWT and greater and be supplied by a submarine slurry pipeline.

Another alternative would be to utilize either the Radio Island or Marsh Island site as a coal terminal but move coal into Morehead City by barge rather than rail. For example, coal might be transported via the Southern Railway system from the Appalachian region to either New Bern or Washington, NC, transferred to barges, then moved to the coal terminal in Morehead City for export. Such a scenario would alleviate the unit train problem in downtown Morehead City, but would, of course, add to the cost of transporting each ton of coal.

Wilmington

Potential sites for a coal export terminal along the Cape Fear River between Wilmington and Southport were identified by project personnel during an aerial and ground reconnaissance on 18 and 19 July 1980. Prospective coal terminal sites (along with possible OCS oil and gas support base sites to be discussed in a subsequent section) are shown in Figure 2-6 and summarized in Table 2-1 . Two coal terminal sites were studied:

Site	Location	Acreage
C-5	West bank of Cape Fear River north of Pfizer Chemical Co.	100-200
C-7	West bank of Cape Fear River south of Sand Hill Creek	100-200

TABLE 2-1

PROSPECTIVE COAL TERMINAL AND

OCS SUPPORT BASE SITES

Site No.	Location (See Figure 2- 5 and 2-6)	City
1	Eagle Island	Wilmington
2	South of Barnard's Creek	Wilmington
3	North of Snow's Cut	Wilmington
4	North of Snow's Cut	Wilmington
C-5	North of Pfizer Chemical Company	Southport
6	South of Pfizer Chemical Company	Southport
C-7	South of Sand Hill Creek/Campbell Island	Wilmington
8	North of Town Creek	Wilmington
9	South of NC 133 on Brunswick River	Wilmington
10	North of W. R. Grace Co. on NE Cape Fear River	Wilmington
11	West of General Electric Co. on NE Cape Fear River	Wilmington
C-12	Radio Island	Morehead City
C-13	Marsh Island	Morehead City
C-14*	Near junction of US 70 and NC 24	Morehead City
15	Adjacent to harbor	Wanchese

*Not considered as a support base site.

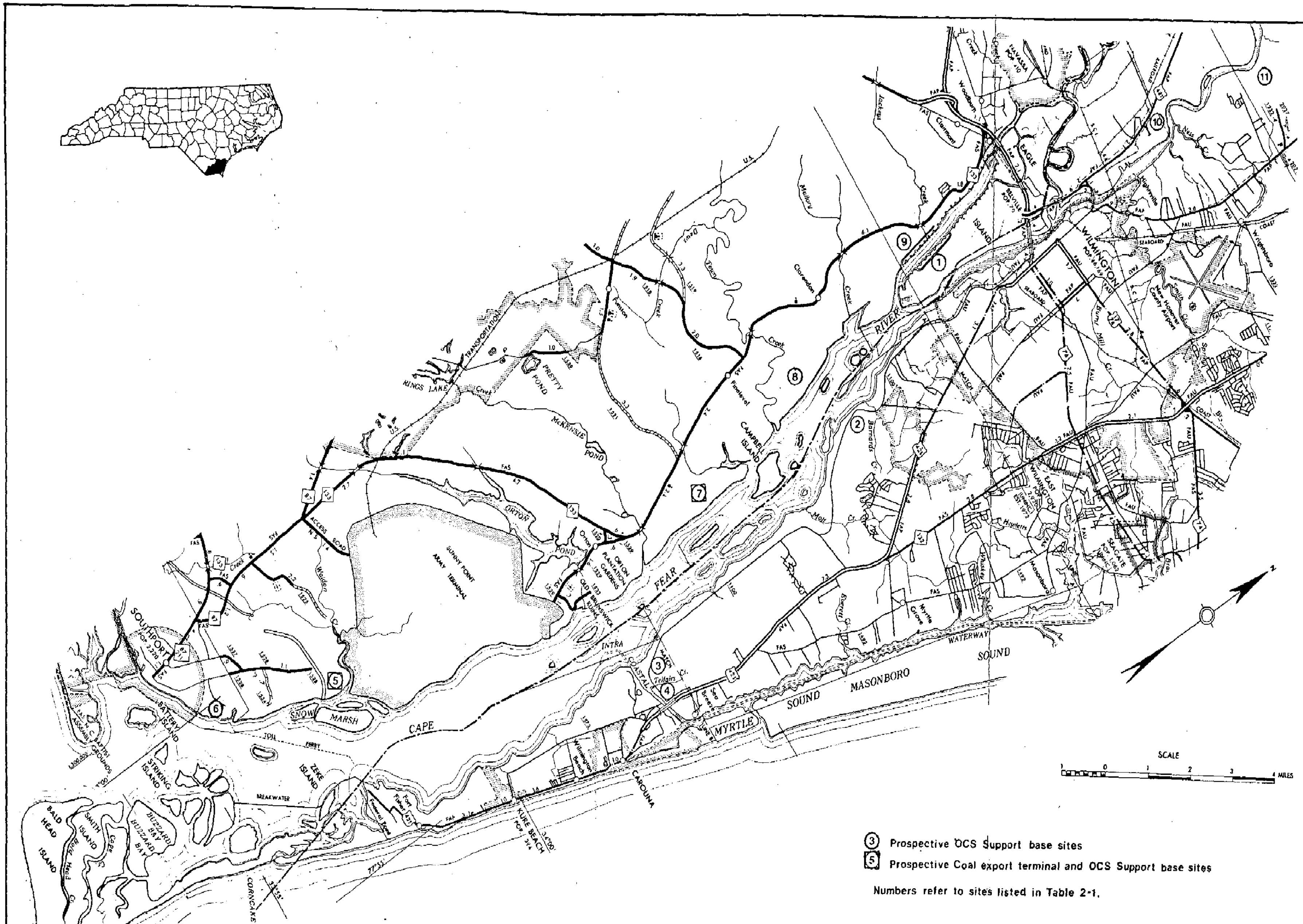


FIGURE 2-6
PROSPECTIVE COAL TERMINAL AND SUPPORT BASE SITES - Cape Fear River

The small number of sites is a result of: (1) inadequate rail access; (2) limited acreage of high ground suitable for industrial development; and/or (3) excessive distance to deepwater channels.

As in Morehead City, a throughput of six to ten million tons of coal has been assumed for either of the Cape Fear River sites. The resulting two or three unit trains per day would create intolerable delays at the existing railroad grade crossings in Wilmington and for this reason possible coal terminal sites on the east side of the river are not recommended. Rail access on the west side of the river is provided by the U.S. government-owned railroad that connects the Seaboard Coast Line system with the Sunny Point Army Terminal. A spur line also serves the nearby Pfizer Chemical Company.

Site C-5 is located north of Pfizer Chemical Company near Snow Marsh Island. The site is on high ground, could easily be connected to the existing rail line with a short spur line, and is reasonably close to the existing 38-foot channel. Site C-7 is also located on high ground on the west side of the Cape Fear River just south of Sand Hill Creek. A spur line to the existing railroad would be needed, as would extensive dredging to link the site with the ship channel.

For either of these sites, vessel numbers and sizes, loading rates, and berth capacities would be similar to those previously estimated for the Morehead City terminal.

2.7 OCS Support Bases

With the proposed sale of tracts for outer continental shelf oil and gas exploration in August 1981, as part of the Bureau of Land Management's Lease Sale No. 56, it is anticipated that North Carolina could be the location for an on-shore support base. Four sites are under consideration: Wilmington, Morehead City, Southport and Wanchese.

The support base activities include receiving and temporary storage of supplies and material for drilling ships and platforms, and shuttle service for workers and supplies by boat and helicopter to the drilling operations. There are no platform fabrication facilities planned for the South Atlantic region at this time. Most of the major platform construction is expected to occur in the Gulf of Mexico (Louisiana and Texas) or possibly a new facility in the Mid-Atlantic region, with the structures barged to the desired locations.

The requirements for an OCS (Outer Continental Shelf) support base are a function of the number of drilling operations. A support base needs to have access to navigable channels, approximately 15-20 feet deep, with deeper waters to accomodate ocean freighters being preferred. Sufficient rail and highway freight capacity must be available to handle all incoming overland freight for the drilling activities. Commericial airline connections appear to be very important to the support base activities, primarily due to the nature of the platform work force. These workers do not normally become residents of the community near the support base. Rather, they travel to their homes, often hundreds of miles away, during their off-time. Work schedules are typically two weeks on duty and two weeks off for production workers.

Of the four sites, Wilmington and Morehead City appear to be the most favorable with respect to the transportation system requirements. However, land must be available, probably on the order of two hundred acres, and this may not be available at all four sites mentioned previously.

The date of start-up of the support base activities could be as early as late 1981, following the lease sale in August of that year, depending on the level of activity developed by the oil companies drilling in the area.

The fourteen potential OCS support base sites which were identified in Table 2-1 are illustrated in Figure 2-7 as they relate to the tracts in lease area 56. Eleven of the sites are located along the Cape Fear River in the Wilmington or Southport areas; two sites are in Morehead City (site C-14 has not been considered as a support base site); and one site has been identified in Wanchese (Figure 2-8).

Specific acreage requirements for a support base will be ascertained in Phase II of this study, but for preliminary planning purposes a 75-100 acre site has been estimated. Channel depths of 15 to 20 feet, which will

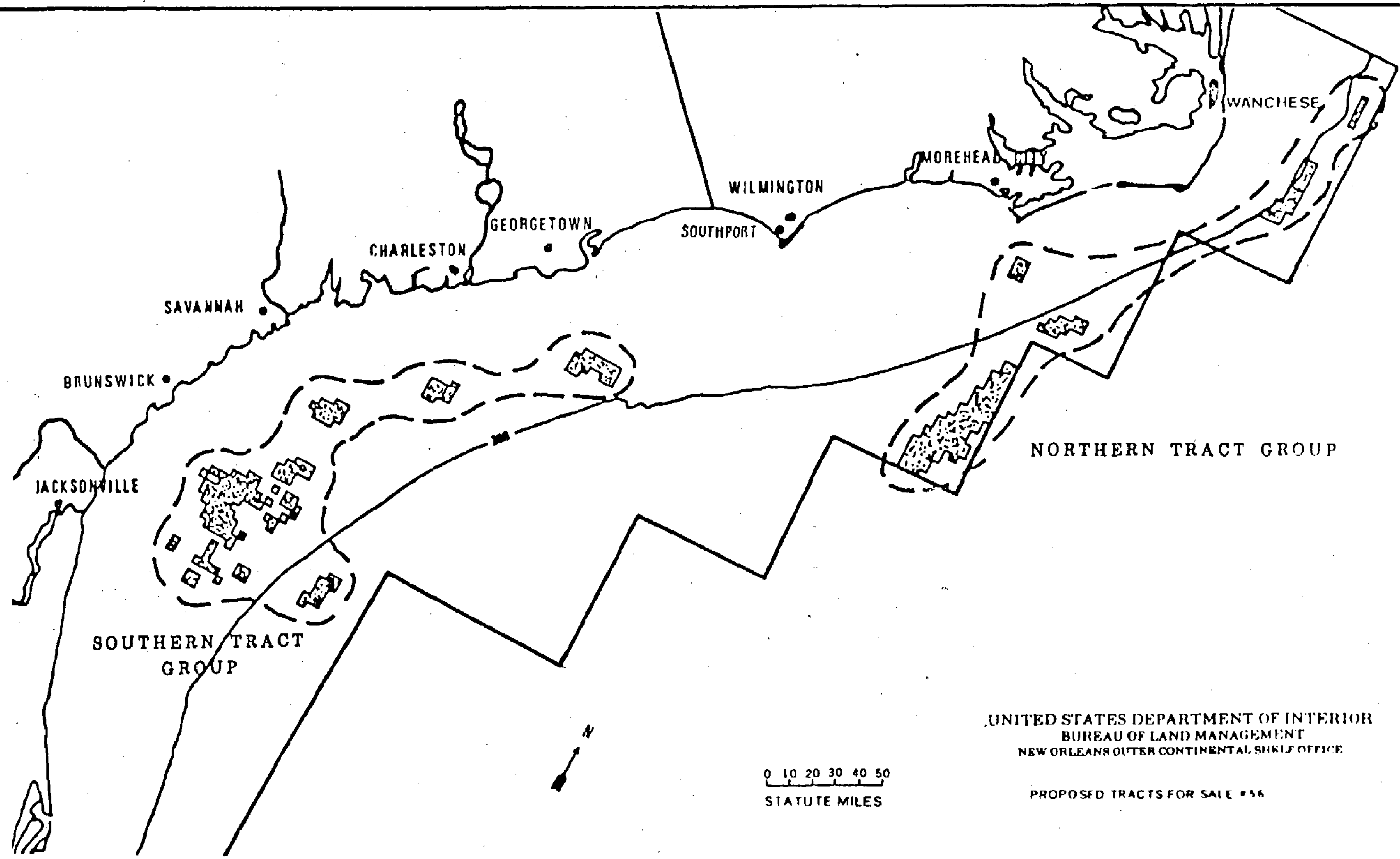


FIGURE 2-7

PROXIMITY OF SUPPORT BASE SITES TO LEASE AREA No. 56

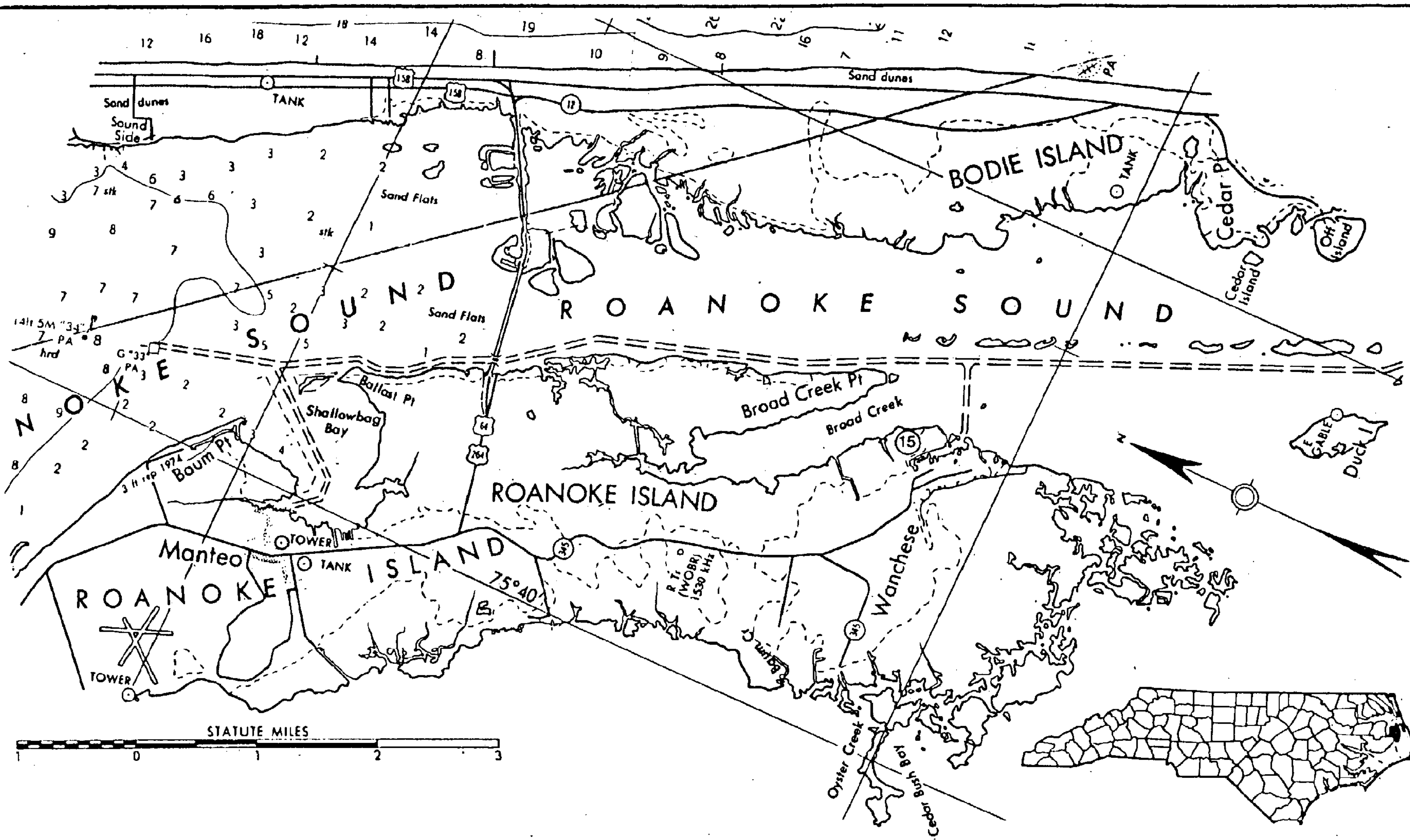


FIGURE 2-8

PROSPECTIVE OCS SUPPORT BASE SITE - Wanchese accomodate barges, crew boats, and supply vessels, will be required. Whether helicopter facilities for personnel movement could best be located at the support base or at an existing airport may change the land requirements.

Although test drilling for oil and natural gas approximately 100 miles off the North Carolina coast is scheduled to begin in October 1980, actual drilling probably will not commence before the Fall of 1981. A parametric analysis of the 14 potential sites comparing their physical and environmental characteristics is shown in Chapter 3.

2.8 Virginia Superport and Refinery Complex

If constructed, an offshore superport and refinery complex proposed for the Norfolk, Virginia area could have major impacts on the transportation system of southeastern Virginia as well as lesser impacts on the northeastern counties of North Carolina. The Commonwealth of Virginia is currently investigating the feasibility of such an energy complex in the Tidewater area. This project would include a deepwater port consisting of single point moorings used for offloading supertankers. Moorings would be located about 50 miles offshore from Virginia Beach in approximately 70 meters of water.

A submarine pipeline would connect the mooring area to the shore south of Virginia Beach where pipelines would carry the crude oil to an industrial/energy park in the less congested Piedmont region of Virginia. This park would include one or more refineries with total capacity of up to one million barrels per day, approximately one-half of the estimated daily throughput of two million barrels per day for the port. The balance of the crude oil off-loaded at the port would be shipped via existing pipelines to the oil and petrochemical complex in the New York - New Jersey area. In addition, plans for the industrial park include an electric generation plant which could be fueled by either coal or the residual fuel oil left from the refineries in the park.

A "new city" of approximately 30,000 acres is planned to house the families of the employees of the refineries, power plant and associated activites (estimated at 100,000 persons). The total cost of such a project is on the order of $1 billion, with about one-half of the total coming from private investment.

The Commonwealth is investigating this project and is hoping to secure the cooperation of neighboring southeastern states in support of such an activity. Because of the uncertainty of the development, it is difficult to estimate the potential effects of the port/refinery complex on the North Carolina coastal zone. Since the project is still in a preliminary proposal stage and since present plans envisage a pipeline system only in Virginia, no energy scenario for the Coastal Study Area will be included in this report.

2.9 Biomass Projects

The major interest in using wood as a source of fuel for electric power generation results from a December, 1979 study conducted by the Research Triangle Institute for the Division of Forest Resources, North Carolina Department of Natural Resources and Community Development, entitled "Impact and Feasibility of Wood or Peat-Fired Electric Generating Plants in the Coastal Zone of North Carolina." The study selected three possible sites and investigated the economic and environmental feasiblity of a 25-megawatt (MW) electric generating plant at each site. The sites identified are: Chowan County near Edenton; Beaufort County near Washington; and Onslow County near Verona. It should be noted that these are only hypothetical sites at this time; specific locations, if developed, have not been identified.

The 25-MW size is fairly small and has a significant cost disadvantage when compared with coal-fired or nuclear power plants. The main consideration in the sizing of the power plants was the available fuel supply within a reasonable haul distance to the plant site. It was estimated that a 25 MW plant would use 292,000 tons of wood chips per year, thus requiring an area of 2,920 acres per year, assuming a wood chip yield of 100 tons per acre.

The primary transportation impact appears to be the movement of wood chips to the site via public highways. The area within a 50-mile radius of each plant would be used to supply wood chips, thus minimizing haul distance. Approximately 65 truckloads of wood chips daily would be added to the highway network within a 50-mile radius of any plant that is constructed.

The findings of the RTI study indicated that a wood-fired 25 MW electric generation power plant would not be economically feasible unless a major change in the price of wood chips and/or high-sulphur coal occurs.

2.10 Minor Projects

Numerous energy projects were identified during meetings with government officials, economic development councils, regional planners and others (see Table 1.1). These projects were classified as "minor" by the study team for one of four reasons: (1) the project is projected, at this time, to require a relatively lower level of capital expenditure; (2) the level of energy production or use is projected to be relatively low; (3) the project is still in the preliminary stages of planning or is only a hypothetical project at this time; or (4) the project is relatively minor from the standpoint of its impacts on the transportation systems of the study area. Obviously, circumstances could change over time that would modify this preliminary assessment. Several of these projects are discussed below.

A study is currently being conducted on the feasibility of exporting municipal solid waste from the Wilmington/New Hanover County area to Horry County, South Carolina, to be used as fuel in a waste-fired electric generation plant. The costs of solid waste transportation and disposal, and the increasing restrictions on sanitary landfills and waste disposal, may make this project not only economically feasible, but also very desirable from both governmental and environmental viewpoints.

Several other projects involving the use of solid waste were mentioned. The possibility of municipal wastes as a feedstock for gasification is being considered. National Spinning Company in Beaufort County is considering a waste-fired boiler for its plant. With increasing costs of disposal of solid waste, and the increasing price and unstable availability of energy sources such as oil, the use of solid waste as a fuel, along with increased resource recovery efforts, will become a necessity. The City of Roanoke Rapids (outside the study area) is also studying the feasibility of using solid waste for steam generation.

The use of water movement through canal locks was mentioned as a possible source of low-level hydro-power for electrical generation. However, only three locks on the Cape Fear River in Bladen County have been identified in the study area to date. These locks, operated by the US Army Corps of Engineers, have lifts of nine to eleven feet and thus have limited energy production capacity, approximately 20-30 megawatts.

The State Ports Authority is exploring the possibilities of a wood chip exportation activity at either Morehead City or Wilmington. This activity could have significant transportation impacts, especially on the rail system and on port traffic.

A proposed plastics manufacturing plant in the Grimesland/Pactolus area of Pitt County could have an impact on barge traffic on the Pamlico and Tar Rivers. This activity, although not an energy producer, could consume a proportionately large share of the energy in the region. The plant could also have major effects on land transportation systems, both rail and highway. This project is still in a very preliminary stage at this time.

Additional energy projects of which some mention has been made include gasohol production; methane production using swine or chicken manure as feedstock; wind, solar and geothermal energy utilization. At this time, it appears that most of these projects, if being considered as viable alternatives to more conventional energy sources, will be too small to have appreciable transportation impacts. All "minor" projects identified in this section will be closely monitored throughout Phase II of this study in order to analyze a complete range of possible impacts on the transportation system.

Obviously, at any time it is possible for additional energy projects to be proposed in the Coastal Study Area. For example, the proposed new synfuels industrial development anywhere in North Carolina could easily have an impact on North Carolina's coastal area. These and other possible future events will come under the purview of this project.

3.0 TRANSPORTATION FACILITIES

3.1 Existing Transportation System

Although the 27-county Coastal Study Area includes large expanses of underdeveloped land, and some counties are underdeveloped in terms of economic activity, its geographic location must be viewed as a major resource in terms of preservation interest and in development potential. As nearby urbanized regions expand, the demand for products (including energy, agricultural commodities, and recreational opportunities) from the Coastal Study Area will continue to grow.

Obviously, the nature and capacity of the transportation system that connects the area with the rest of the state and links activities within the area will strongly influence the development potential of the region. The major modes encompassed by this system are discussed in the following subsections.

3.1.1 Highways

The highway system serving the Coastal Study Area is depicted in Figure 3-1. The region currently has reasonably good east-west access to the Piedmont area via US 158, 64, 264, 70, 421, and 74. Of these routes, US 70 is essentially a four-lane facility from Morehead City to Raleigh, while US 64 is gradually being upgraded to four lanes from Plymouth to Raleigh. North Carolina Department of Transportation (NCDOT) engineers are also developing plans for the ultimate extension of an interstate-type facility from I-95 to the port facilities at Wilmington (See Figure 3-2). When completed, this facility will provide access to an integrated network of interstate highways serving the entire state.

Access in the north-south direction within the Coastal Study Area is somewhat limited. US 17 accommodates substantial vehicular traffic and is supplemented in varying degrees by US 13, 258, and 117. Parallel and just

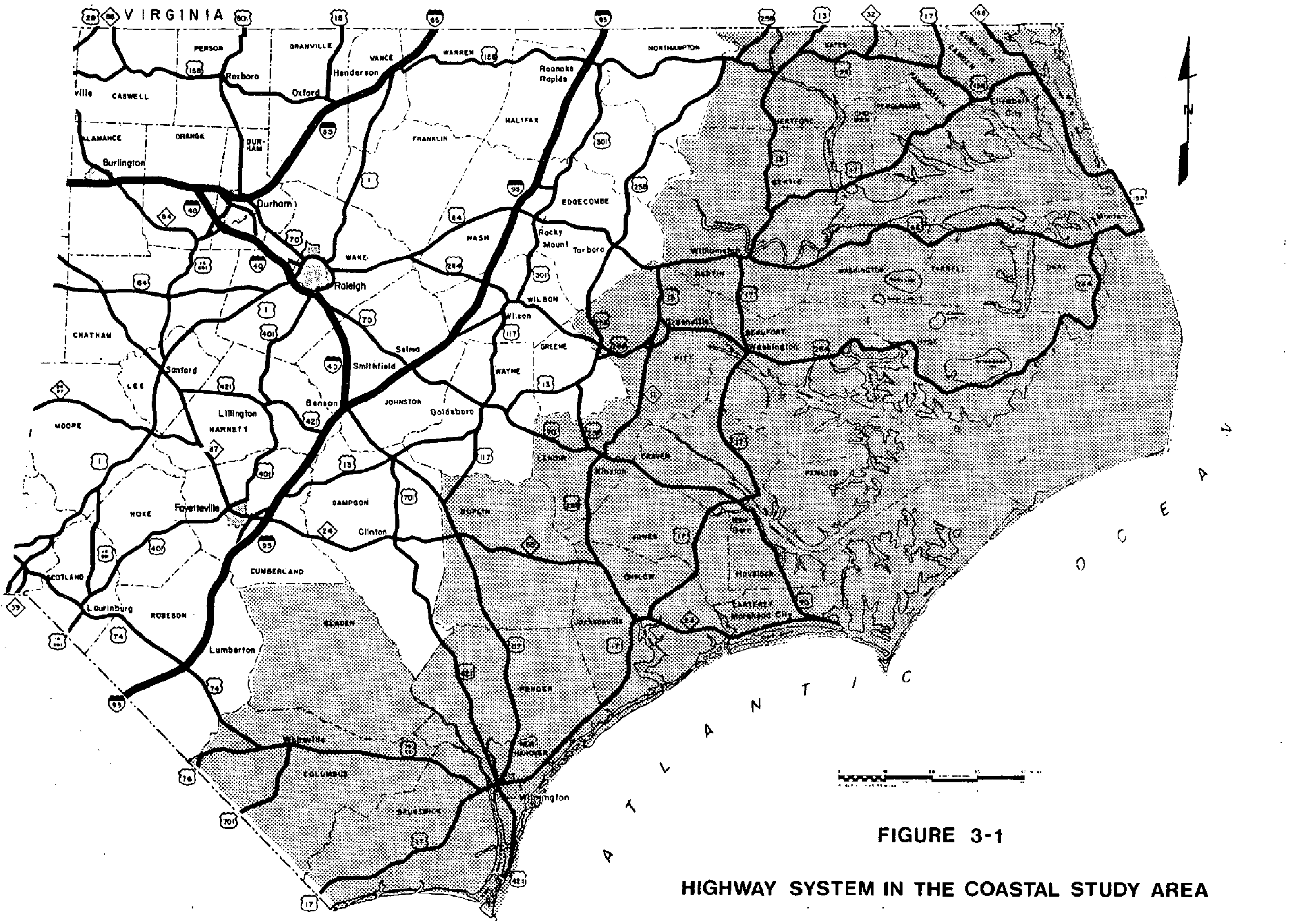


FIGURE 3-1

HIGHWAY SYSTEM IN THE COASTAL STUDY AREA

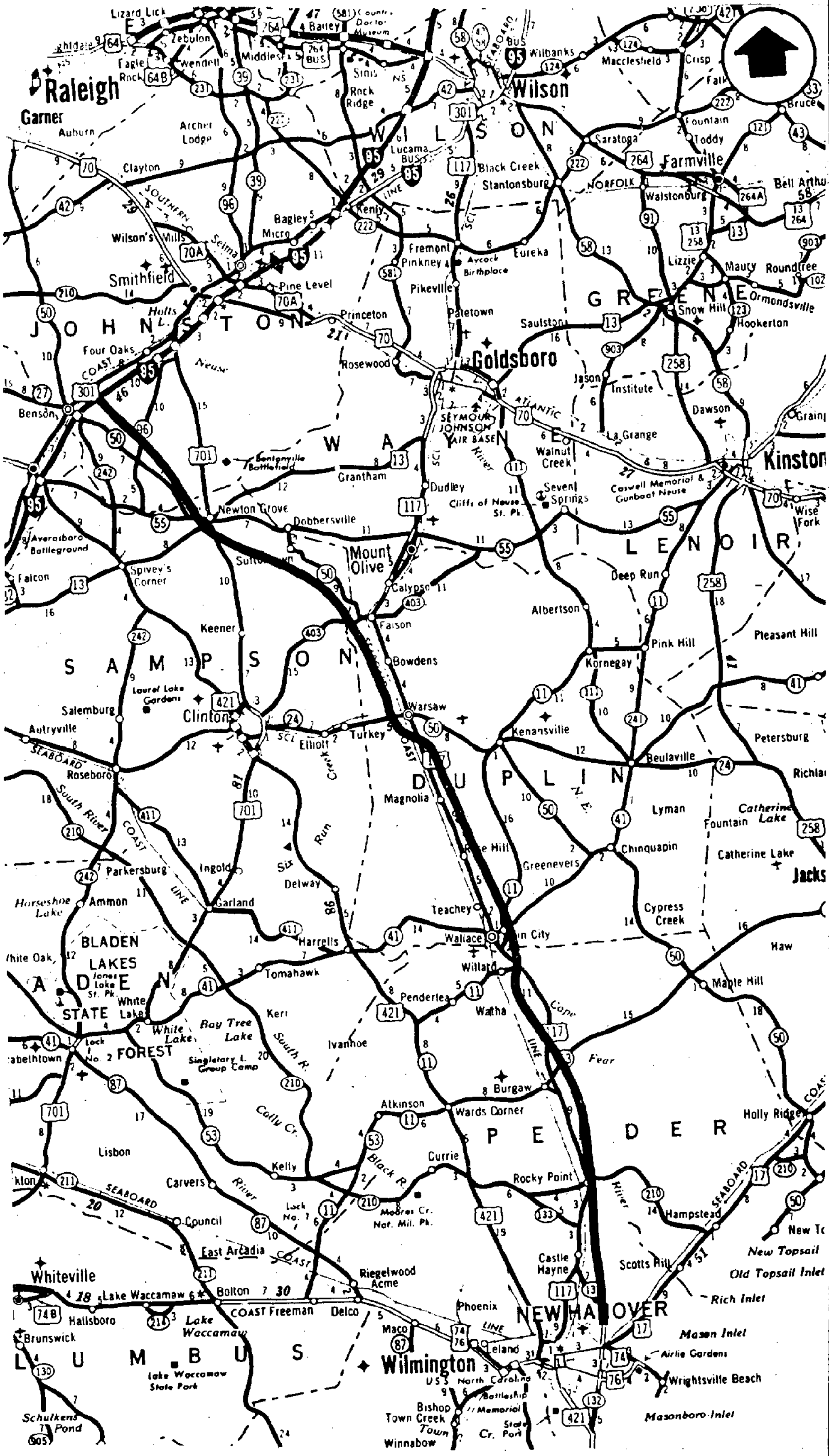


FIGURE 3-2
NEW CORRIDOR, I-95 TO PORT OF WILMINGTON

Construct an Interstate type facility on new location to the Port of Wilmington west of the Study Area, I-95 is a major north-south corridor connecting the heavily urbanized northeast US with Florida.

During the next decade, when most of the energy-related projects are expected to come onstream, many segments of the existing highway network in the Study Area will become physically or functionally obsolete. The NCDOT has addressed this problem in their 1980-1986 Transportation Improvement Program (TIP) by identifying specific routes that had capacity deficiencies in 1979 or anticipated capacity deficiencies by 1999. Route deficiencies are illustrated on the map in Figure 3-3 and will be discussed in greater detail in subsequent sections of the report.

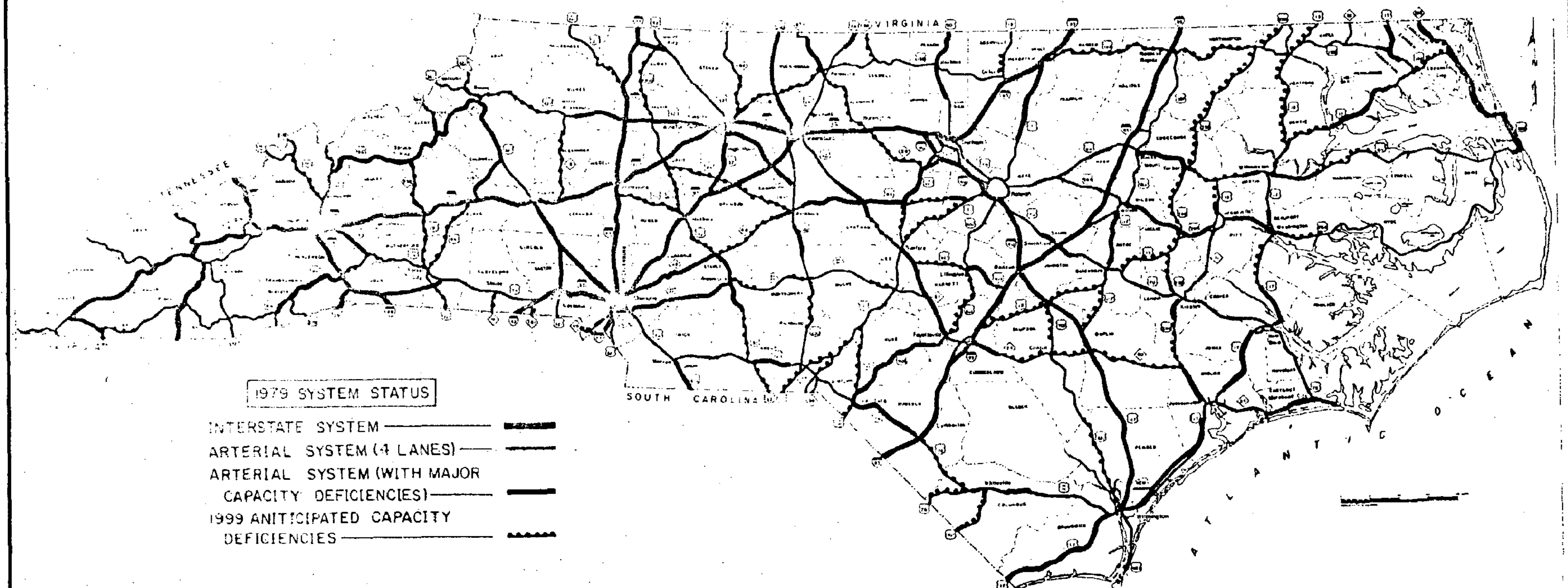
3.1.2 Railroads

The railroad system serving the Coastal Study Area along with 1978 traffic densities is shown in Figure 3-4. Traffic density data (expressed in million gross ton-miles per mile of track per year) were originally supplied by the individual railroads and were compiled in the NCDOT North Carolina Rail Plan, 1979.

In performing the function of providing necessary transport services for industry and commerce, there is little doubt that the railroad system is an integral part of the Study Area's economy. Although the state possesses over 4,000 miles of rail track operated by 23 different railroad companies, the rail network in the Coastal Study Area is relatively sparse - indeed, several counties (Tyrell, Dare, Hyde and Pamlico) are completely without rail service. Figure 3-4 indicates that the region's system is dominated by the Seaboard Coast Line (part of the Family Lines System) and Southern Railway companies. While the major rail lines in the state are oriented in a north-south direction, east-west lines to serve the two deepwater ports are also available. There is no rail passenger service within the Coastal Study Area.

3.1.3 Water Transportation

The Study Area is richly endowed with a water transportation system that includes two deepwater harbors and the Atlantic Intracoastal Waterway



NORTH CAROLINA ARTERIAL SYSTEM

FIGURE 3-3

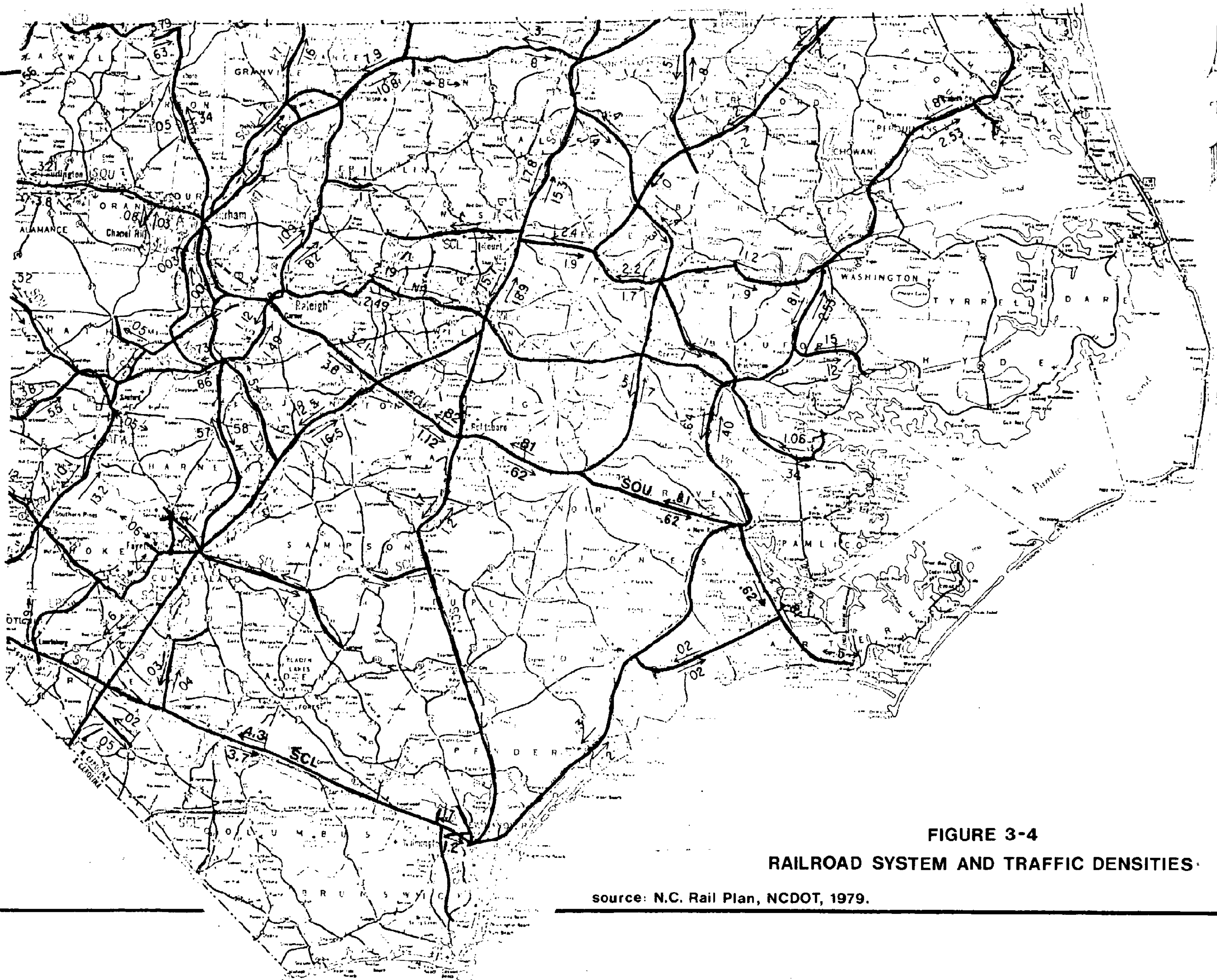


FIGURE 3-4

RAILROAD SYSTEM AND TRAFFIC DENSITIES

source: N.C. Rail Plan, NCDOT, 1979.

(AIWW) which extends along the entire coastline from Virginia to South Carolina. Port facilities, navigable rivers, sounds, the Intracoastal Waterway and other navigation resources have played a dominant role in the Area's development, and a brief review of the systems is in order.

Figure 3-5 depicts the existing navigation projects within the Study Area. The water transportation system can best be described by separating it into the following categories:

1. Commercial shipping
   a) Deepwater ports
      - Wilmington
      - Morehead City
   b) Atlantic Intracoastal Waterway (AIWW)
   c) Navigable rivers
2. Small navigation projects

The small navigation projects, which include commercial and sports fishing as well as recreational boating, are beyond the scope of this project, but the commercial shipping category deserves additional description.

Wilmington Port Facilities - The State Ports Authority Terminal in Wilmington and the small-boat basin in Southport are administered by the NC State Ports Authority (SPA). In addition to the SPA Terminal, which is the port's only containerized and general cargo facility, several oil terminals and bulk-handling facilities for asphalt, chemicals, ores and other products are available. Railroad and highway facilities are provided into the port area and a project depth of 38 feet in the Cape Fear River allows vessels up to 70,000 deadweight tons (DWT) to enter the port.

Morehead City Port Facilities - Facilities in Morehead City (40-feet project depth in channel) include the SPA Terminal and its barge facility at the northeast corner of the terminal and privately operated oil and sulphur terminals on Radio Island. The port is served by US 70 and State Route 24. The city is linked to the Southern Railway System through the Atlantic and East Carolina Railway. Substantial rail movements from Radio

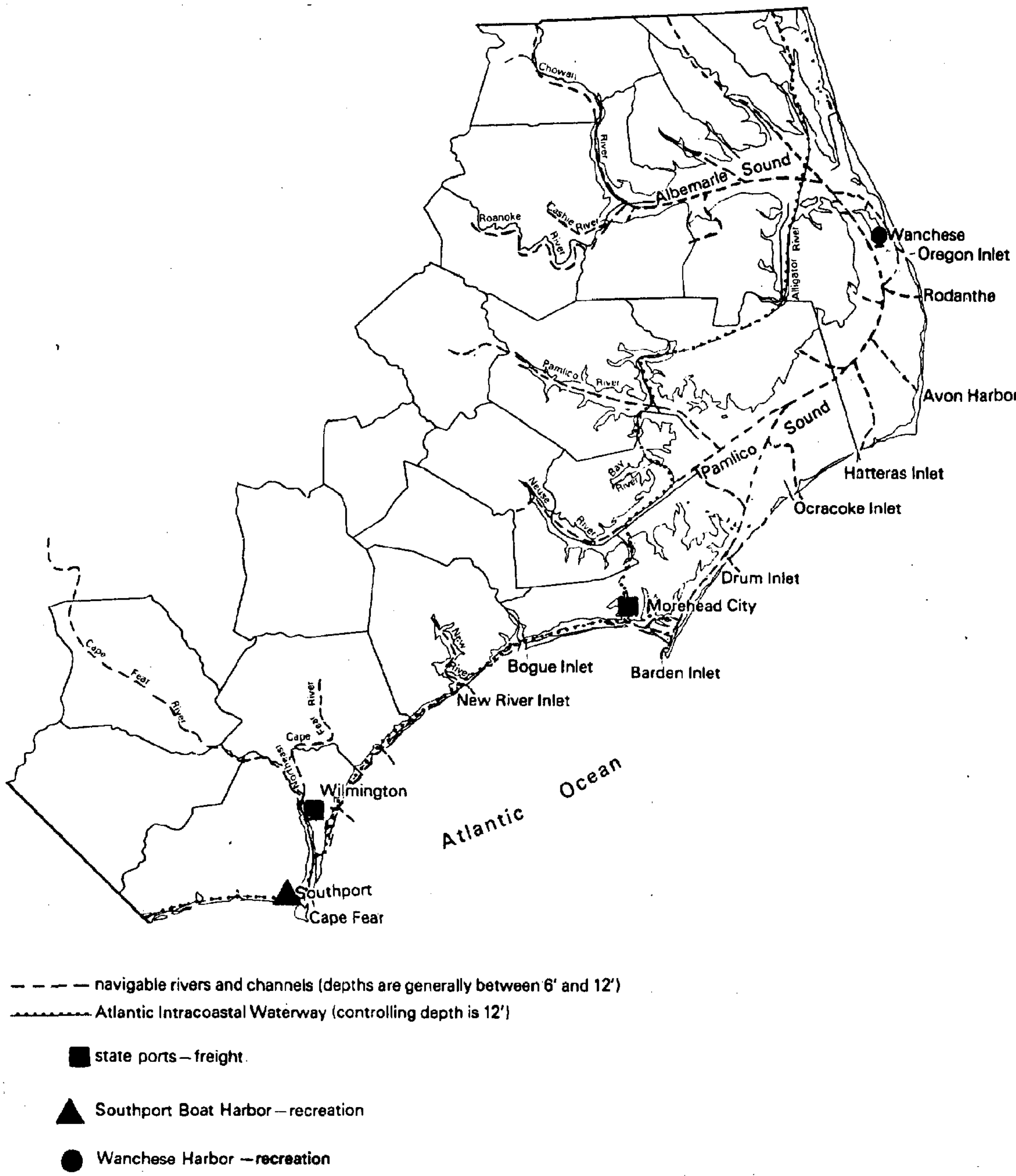


FIGURE 3-5
EXISTING NAVIGATION PROJECTS

source: N.C. Atlas, p. 232.

Island are accommodated by the three-mile Beaufort and Morehead Railroad connecting the city with Beaufort.

Atlantic Intracoastal Waterway - When the AIWW is combined with the Wilmington and Morehead City Harbors, the three account for approximately 85% of the state's waterborne tonnage. Traffic on the 12-foot deep AIWW is composed primarily of barge tows and private boats.

Several rivers shown in Figure 3-5 also accommodate barge traffic up to the head of navigation. The US Army Corps of Engineers' publication "Waterborne Commerce of the United States, 1977" reveals the following freight traffic in the Coastal Study Area:

		Thousand Short Tons
Wilmington		9,505
Morehead City		2,875
Atlantic Intracoastal Waterway		3,344
Navigable Rivers		3,002
Northeast (Cape Fear)	377	
Chowan	258	
Roanoke	551	
Pamlico and Tar	1,173	
Neuse	272	
Cape Fear	371	

3.1.4 Pipelines

The pipeline system serving the Coastal Study Area is dominated by natural gas lines that branch off the Transcontinental Gas Pipeline Corporation's main line in the Piedmont. The state's pipeline system shown in Figure 3-6 also reveals the presence of three petroleum product pipelines (Colonial, Plantation and Dixie) which traverse the Piedmont but do not serve the Study Area. Petroleum products are usually distributed in the Area by truck, barge or rail after transfer from oceangoing tankers at Wilmington or Morehead City.

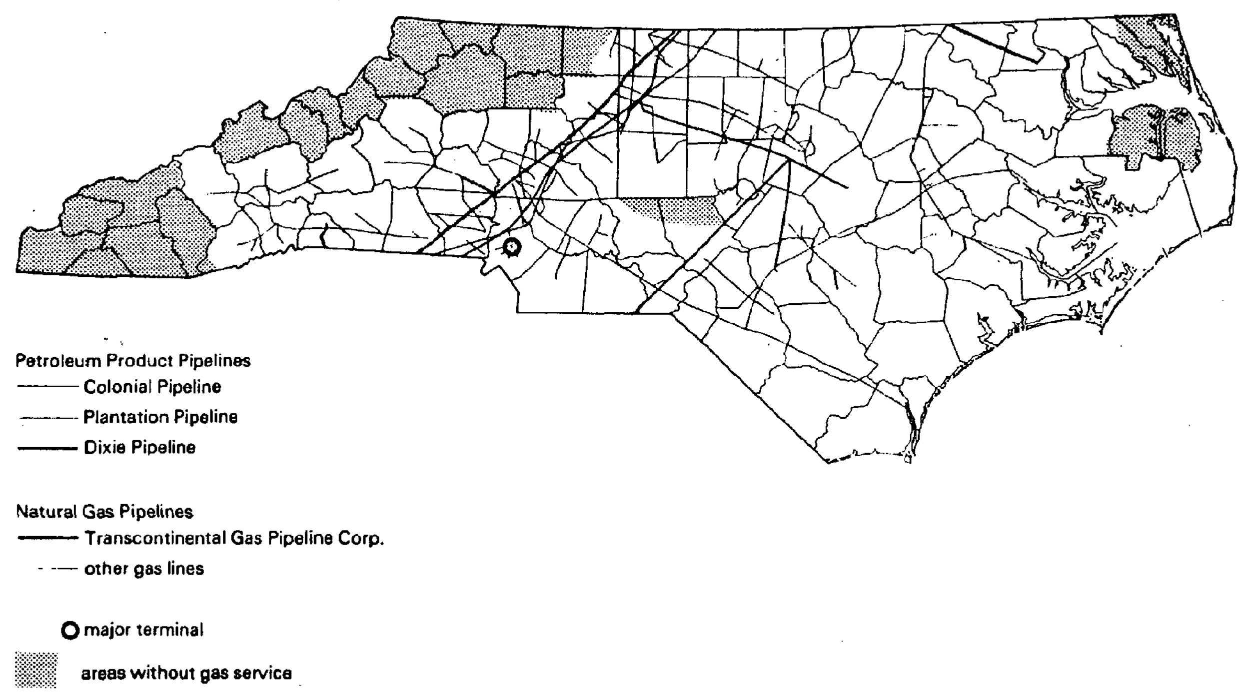


FIGURE 3-6

NORTH CAROLINA PIPELINE SYSTEM

source: N.C. Atlas, p. 244.

Most cities in the Study Area have natural gas; however, four counties - Camden, Currituck, Tyrell and Dare - have no gas service. Natural gas lines terminate at Washington, New Bern and Wilmington. The entire supply of natural gas originates in Texas and Louisiana and is shipped to North Carolina via the Transcontinental trunk line and then distributed to consumers in the Coastal Study Area by several gas utility companies and municipal gas systems. All gas pipelines in the Area are regulated by the North Carolina Utilities Commission.

3.1.5 Air Transportation

The Coastal Study Area's portion of the State Airport System is illustrated in Figure 3-7. Air carrier airports at Wilmington, Jacksonville, Kinston and New Bern constitute the major hubs and generate most of the traffic from the Area. Several other airports, which have commuter service, provide vital connections between the air carrier airports and smaller cities.

In 1979, the North Carolina Airport System Plan evaluated the existing public and significant privately-owned, public-use airport facilities in terms of their ability to accommodate the aeronautical needs of each of the state's 17 multi-county planning regions. Primary deficiencies were identified in terms of capacity and service, and alternatives for correcting these deficiencies were analyzed and recommended. More recently, the Fiscal Year 1980 Aviation Element of the North Carolina Transportation Improvement Program prioritized airport needs and made funding determinations affecting 46 airports statewide, including several in the Coastal Study Area.

3.2 Transport Need Projections

Because it is anticipated that a major portion of Phase II of this study will be devoted to a detailed assessment of transportation impacts created by the candidate energy projects, the needs projections described in subsequent sections do not include comparisons of alternative transport strategies. These will be addressed in Phase II with a view towards the possible identification of alternative routes, modes, or technologies that might mitigate the impacts upon the existing transportation system.

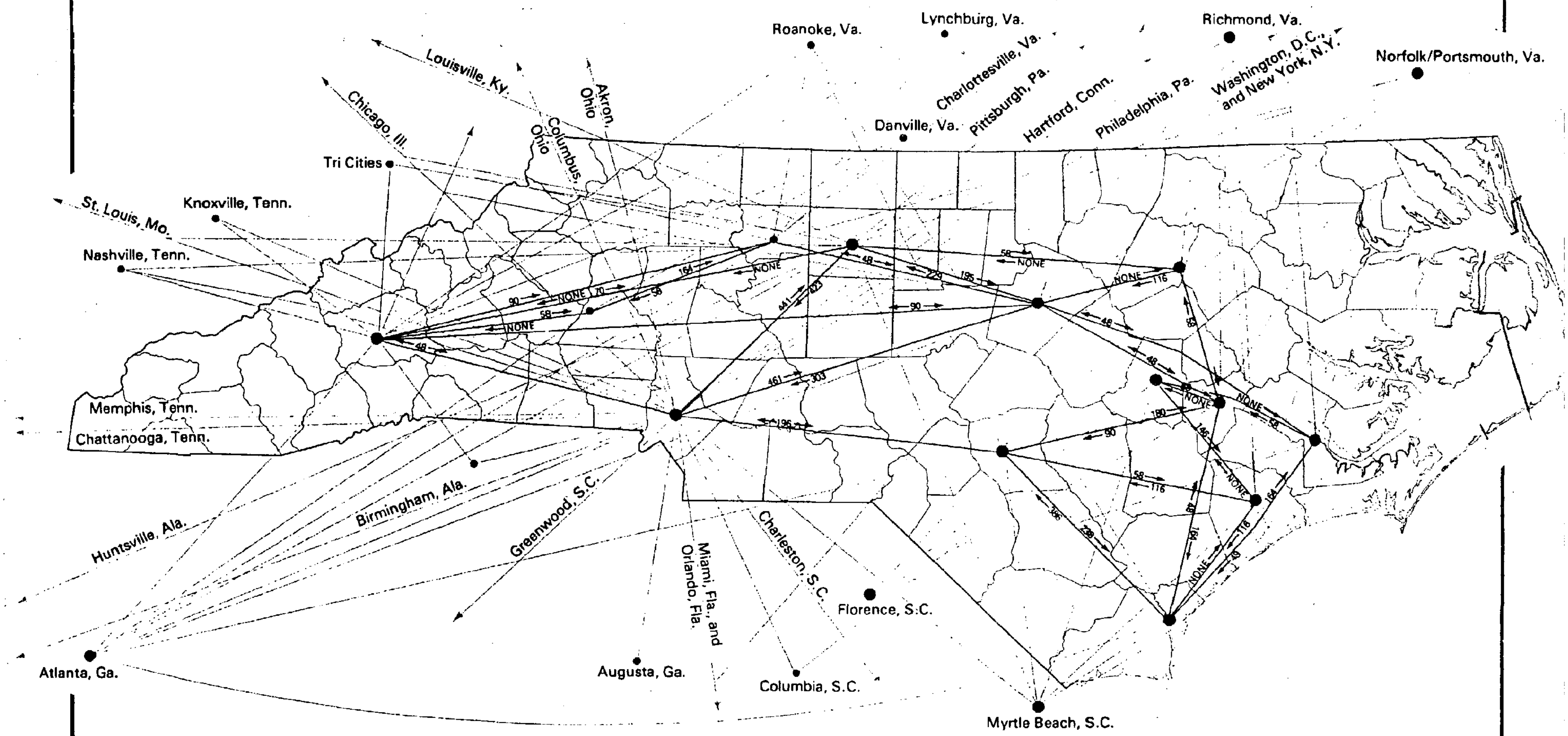


FIGURE 3-7

DAILY INTRASTATE SEAT CAPACITY AND INTERSTATE AIR ROUTES

source: N.C. Atlas, p. 227.

The development of a coal export terminal in Morehead City provides an excellent example of the need for an evaluation of alternative strategies. A range of alternatives that were briefly mentioned in Section 2.6.3 is depicted in Figure 3-8. Export coal is usually moved from the mine mouth to a loading tipple by truck or rail and then proceeds to a port by rail, barge, or truck depending on length of haul, competitive rates, and geographic limitations. Slurry pipelines are a possible future alternative for this movement if problems related to water rights and right-of-way clearances can be resolved.

Shipping coal directly to the State Ports Authority facility in Morehead City from Appalachia by Southern Railroad may create major vehicular delays and other disruptions in downtown Morehead City and perhaps other urban areas along the route. This problem coupled with normal environmental concerns, makes it imperative to seek alternative means of moving the coal to vessels for export.

Among the alternatives to be investigated in Phase II (Figure 3-8) are (1) possible barge movements from New Bern or Washington, (2) a new railroad, conveyor system, or slurry pipeline from an open storage area west of the city that would bypass the urban area, (3) another slurry pipeline from this same storage area to an offshore deepwater loading terminal, and (4) deepening the harbor and approach channel to accommodate larger bulk vessels. These alternatives and others not yet identified will be compared to determine which promises the greatest economic benefits while minimizing negative impacts on the environment and the economy of the affected areas.

The nine major energy projects identified in Chapter 2 will obviously impact the transportation system in the Coastal Study Area in varying degrees. Transportation infrastructure requirements for five subsystems - rail, highway, water, pipeline, and air - are summarized in Table 3-1 and individual modal requirements are discussed in the following sections.

TABLE 3.1

TRANSPORTATION INFRASTRUCTURE REQUIREMENTS IN COASTAL STUDY AREA

Project	Rail System	Highway System	Water Transp. System	Pipeline System	Air Transp. System	Marine Terminals
1. Coal Export Terminal	inbound=2-3 unit trains/day (Wilmington) inbound=2-3 unit trains/day (Morehead City)	--	Outbound 100-170 60,000 DWT ves./yr. (Wilmington) 100-170 60,000 DWT ves./yr. (Morehead City) Inbound possible barge tows to replace unit trains (Morehead City)	possible slurry pipeline from site C-14 to offshore loading terminal.	--	1000' wharf/terminal
2. BECO Refinery	outbound-20 rail cars/day	outbound-140 trucks/day	Inbound 3-50,000 DWT tankers/wk. Outbound 130 ships or seagoing barges/yr. 425 barge/yr. on AIWW	underwater pipeline from T-head pier on east side of Cape Fear River to refinery	Air Carrier Service	1 "T" head pier
3. CRDC Refinery	--	outbound-110 trucks/day	Inbound 1-40,000 DWT tankers/wk. Outbound 60 barges/yr. on AIWW	4-mile pipeline from SPA terminal to refinery on Newport River	--	Use existing "T" head pier
4. LPG Terminal	outbound-10 rail cars/day	outbound-110 trucks/day	Inbound 30-40,000 DWT Tkrs./yr.	From terminal to railline west of Morehead		1 "T" head pier
5. OCS Support Base	--	inbound-30 trucks/day	20,000 DWT shuttle tkrs. from central offshore storage to onshore marine	Underwater pipelines from drilling sites to onshore storage***	Helicopter and Air Carrier Service	300' wharf/rig (exploration) 175' wharf/platform (operations)
6. Aluminum Processing Plant*	inbound-16 rail cars/day outbound-6 rail cars/day	outbound-16 trucks/day	Inbound-1-40,000 DWT ves. every 4 wks. Outbound-1-20,000 DWT ves. every 4 wks.	--	--	Use existing SPA terminals
7. Peat Projects	private rail/conveyor system	--	Outbound-(low)-5 barges/wk. (Med)-10-15/wk. (High)-20-25/wk.	--	--	Barge loading platforms
8. Biomass Project	--	outbound-65 trucks/day	--	--	--	--
9. VA Superport Complex**	--	--	--	--	--	--

*Transmission lines to supply electricity will be treated as a separate transportation system in Phase II.
**Unknown requirements at this time.
***Also requires 200' wharf.

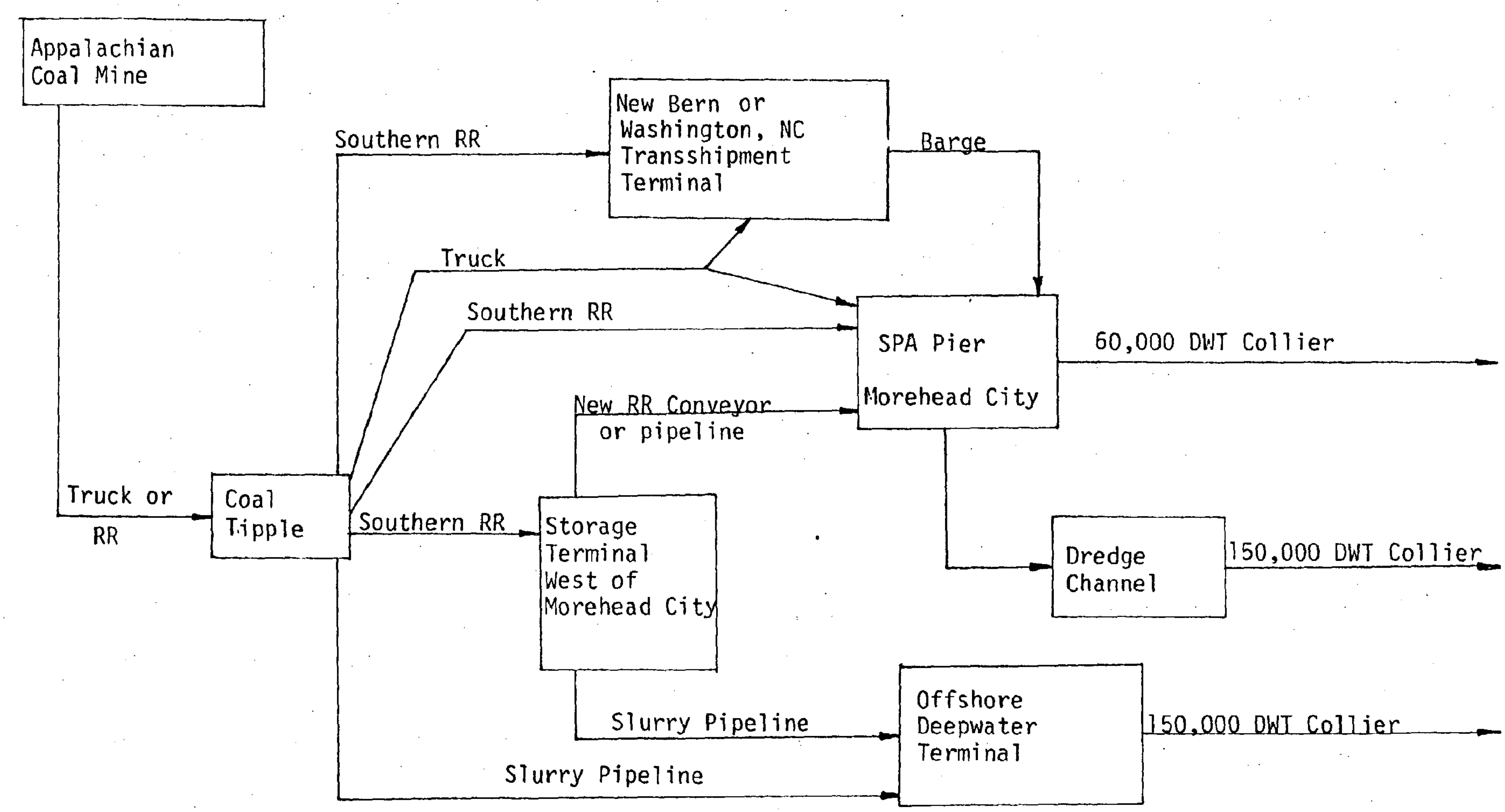


FIGURE 3-8

ALTERNATIVE STRATEGIES FOR TRANSPORTING EXPORT COAL THROUGH MOREHEAD CITY

3.2.1. Rail System

Because of their magnitudes, impacts on the rail system need to be carefully evaluated. Table 3-1 indicates that these impacts will be most severe on the Seaboard Coast Line system serving Wilmington from the west and the Southern system serving Morehead City from the west. Estimates of new commodities are as follows:

System	Section	New Commodities (Annual Throughput)
Seaboard Coast Line	Pembroke to Wilmington	6-10 million tons of coal
		3 million barrels of petroleum products
		400,000 tons of alumina
		100,000 tons of petroleum coke
		200,000 tons of aluminum products
Southern Railway	Kinston to Morehead City	6-10 million tons of coal
		3 million gallons of LPG

If each of these energy projects were constructed, substantial quantities of coal, aluminum, coke, LPG, and petroleum products would utilize the two major rail systems in order to enter or leave the port areas.

Existing (1978) rail traffic densities were depicted in Figure 3-4. These densities reflect millions of annual gross ton-miles per mile of track. Thus, 4.3 indicates 4,300,000 gross ton-miles westbound between Wilmington and Pembroke. Since gross ton-miles include not only the weight of the freight hauled but also the weight of the locomotives and rolling stock, projected tonnages generated by the new energy projects must be converted to the same base. In order to compensate for these weights, gross ton-miles have been reduced by 30% before combining with the annual throughputs shown above. The resulting net tonnages for each of the heavily impacted rail systems are summarized below:

Seaboard Coast Line (Pembroke to Wilmington)		Annual Net Tonnage
a) Eastbound		
- Existing		2,600,000
- Coal		6,000,000 - 10,000,000
- Aluminum products		200,000
	Total Eastbound	8,800,000 - 12,800,000
b) Westbound		
- Existing		3,010,000
- Aluminum		400,000
- Petroleum Coke		100,000
- Petroleum Products		10,000
	Total Westbound	3,520,000

Southern Railroad (Kinston to Morehead City)		
a) Eastbound		
- Existing		430,000
- Coal		6,000,000 - 10,000,000
	Total Eastbound	6,430,000 - 10,430,000
b) Westbound		
- Existing		570,000
- LPG		10,000
	Total Westbound	580,000

A review of the 1979 North Carolina Rail Plan reveals that a number of the most heavily utilized sections of track in the state carry in excess of 20 million net tons per year. Since both of the impacted lines are classified as A Mainline (with the exception of the New Bern to Morehead City section of the Southern System which is classified as A Branchline), it does not appear that the net tonnages shown above will exceed capacities of the lines-provided that the roadbeds are in satisfactory condition. Clearances to use the US Government spur line from Wilmington to Sunny Point, and to extend that line further south for coal movement, have not been explored. The condition of the railway roadbed has likewise not been explored.

3.2.2 Highway System

Principal impacts on the existing highway system will result from the movement of energy feedstocks and products by truck and the movement of employees and construction workers to and from the project sites. The inventory of major energy projects revealed that peak operating employment at each of the sites would in no case exceed the peak construction employment so projected traffic volume increases will be based on construction periods where critical conditions exist.

Estimates of generated traffic in Table 3-2 assume a vehicle occupancy ratio of 2.5 persons per vehicle. In every case except the biomass project, traffic during construction will be heavier than during operation. Projected volumes of generated traffic have been added to existing traffic on the critical routes shown, then converted to hourly demand volumes for comparison with capacity estimates. While minor capacity problems may exist on service roads and entrances to the facilities under study, Table 3-2 reveals that the only capacity problem on a major route will be on US 70 at the Morehead City - Beaufort Bridge. Congestion problems at this location already exist during peak periods and the proposed energy projects actually do not add significantly to existing volume.

3.2.3 Water Transportation System

Impacts on the Coastal Study Area's water transportation system will manifest themselves in the form of increased vessel and barge traffic in the port areas and approach channels at Morehead City and Wilmington and increased barge traffic along the Atlantic Intracoastal Waterway. Specific impacts for each project are listed in Table 3-1 and summarized by facility below:

Morehead City

Number	Description	Project
2-3	60,000 DWT colliers/week	coal
1	40,000 DWT tanker/week	CRDC
1	40,000 DWT tanker/2 week	LPG
1	Barge/week	CRDC
1	20,000 DWT tanker/week	OCS

TABLE 3-2

HIGHWAY IMPACTS

	Generated Traffic					Total Projected Traffic			
	Estimated Vehicles Per Day in Both Directions				Critical Generated Volume (vpd)	Present ADT (vpd)	Total Demand Volume (vph)	Capacity (vph)	Routes Impacted
	Construction		Operation						
	Auto	Trucks	Auto	Trucks					
1. Coal Terminal	800	160	80	20	960	3,800 19,100 3,200	480 2,010 420	1,400 5,000 1,400	Southport-SR 133 Morehead-US 70 Wilmington-SR 133
2. BECO Refinery	2,400	480	280	280	2,880	5,500	840	5,000	US 17
3. CRDC Refinery	1,600	320	140	220	1,920	1,700	360	1,400	SR 101
4. LPG Terminal	160	30	10	220	190	13,520	1,370	1,400	US 70
5. OCS Support Base	160	30	120	60	190	13,520 3,800 3,200 400	1,370 400 340 60	1,400 1,400 1,400 1,400	Morehead-US 70 Southport-SR 133 Wilmington-SR 133 Wanchese-SR 345
6. Alum. Smelter	1,600	320	800	32	1,920	340	230	1,400	SR 1314
7. Peat Projects	1,600	320	400	20	1,920	5,380	730	1,400	US 64
8. Biomass Project	100	20	80	130	210	3,740 13,800 6,200	400 1,400 640	1,400 5,000 1,400	Edenton-US 17 Washington-US 17 Verona-US 17

Wilmington

Number	Description	Project
2-3	60,000 DWT colliers/week	coal
3	50,000 DWT tankers/week	BECO
2-3	Tankers or seagoing barges/week	BECO
8	Barges/week	BECO
1	40,000 DWT vessel/4 weeks	alum.
1	20,000 DWT vessel/4 weeks	alum.
1	20,000 DWT tanker/week	OCS

If all the projects proposed for the Morehead City area (coal terminal, CRDC Refinery, and LPG Terminal) were constructed, an average of five and one half additional ships per week could be expected in the port under a maximum production scenario. Also, one barge per week would be added to existing AIWW traffic. The addition of an OCS support base at Radio Island or Marsh Island could add a fair number of small supply boats and barges to this total, but it does not appear that port capacity or vessel safety would be endangered.

Vessel traffic in the port of Wilmington under a full production scenario would be somewhat heavier with eight to twelve ships per week added to existing arrivals and departures and eight barges per week added to AIWW traffic. Again, these totals, two additional ships and one barge per day, do not appear to present substantial capacity problems for the port of Wilmington. A few supply boats and barges for an OCS support base might also be added to traffic on the Cape Fear River. Since vessel arrivals at a port can be expected to be somewhat random, some peaking should be anticipated, but pilot and tugboat requirements will usually result in adequate ship headways.

If peat is moved by barge from Washington County deposits, as many as four barges per day would be added to AIWW traffic between Albemarle and Pamlico Sounds.

3.2.4 Pipeline System

Two relatively short pipelines connecting the proposed BECO and CRDC refineries with their respective tanker unloading terminals will be buried beneath the water and have little impact on other existing transport systems.

If constructed, a possible coal slurry pipeline from a coal storage area (site C-14) in Morehead City to an offshore loading terminal would have to cross several rail and highway rights-of-way as well as environmentally sensitive areas in Bogue Sound and Atlantic Beach. Because no specific plans are known to be underway for this project, no assessment of its impacts will be undertaken in this phase of the study.

Undoubtedly, the most significant impacts from a pipeline system will be created by large diameter (61-91 cm.) marine pipelines proposed for OCS oil and gas lease areas off the North Carolina coasts. According to the U.S. Department of Interior's Draft Environmental Impact Statement for the Proposed 1981 Outer Continental Shelf Oil and Gas lease sale No. 56, one oil and one gas marine pipeline would be required to serve the Northern Tract Groups under a High Recovery Estimate Scenario. The Statement also suggests that between 140 and 600 miles of pipelines might be required to serve the lease area, and that a maximum of two onshore terminals could be constructed. The most likely landfalls for these pipelines would be near the probable onshore facility locations.

While it is difficult to establish precise pipeline corridors prior to the discovery of hydrocarbon resources, another CEIP project [1] is currently underway with a view towards determining several pipeline corridor locations within the Coastal Study Area. Results are not anticipated during Phase I of this study, but project personnel will coordinate the findings of the pipeline study with OCS impact assessments during Phase II.

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[1] CEIP Project 80-B-19, "Impact of Offshore Pipeline Corridors and Landfalls in Coastal North Carolina," conducted by the Department of Marine Science and Engineering, North Carolina State University.

3.2.5 Air Transportation System

At this early stage in the planning process, impacts on the air transportation system are virtually impossible to predict. However, substantial increases in passenger movements at both Wilmington and Morehead City could be anticipated during the construction periods for any one of the major energy projects. The airlines serving these two airports have the capability to increase the frequency and capacity of their flights as the demand increases.

Perhaps of greater significance to the air transportation system are the long-range impacts that could be expected from OCS oil and gas leases and their onshore support bases. If located in the Coastal Study Area, an onshore support base most certainly would include a helicopter base. Whether such a base should be located with other support facilities or at an existing airport where navigation aids and other facilities are already provided will be determined in Phase II of this study.

3.2.6 Electrical Transmission System

As indicated in Table 3-1, transmission lines that supply electricity to the proposed aluminum processing plant in Columbus County will serve as a transportation system in that they replace the need for a highway, railroad, or pipeline to supply the energy required in the smelting process. The immediate concern in Phase I of the study was an assessment of the impacts on the transportation system created by the movement of personnel, raw materials, and finished products during either the construction or operation stages of the smelter. However, the various impacts occasioned by the transmission of 325 megawatts of electricity from Carolina Power and Light Company generating stations to the smelter also need to be addressed. Generating plant locations, transmission line routes and impacts, as well as the possibility of utilizing alternative strategies, will be explored in Phase II.

3.3 Parametric Analysis, Coal Sites and Support Base Sites

Fourteen alternative sites for a potential OCS support base and five coal terminal sites were identified in Chapter 4. Four of the sites (C-6, C-7, C-12, and C-13) were earmarked as possible coal terminals and as support bases, while one location, Radio Island (site C-12) was identified as a prospective location for three of the energy projects - OCS support base, coal export terminal, and LPG terminal. Thus, some analysis of the sites with respect to competing land uses is in order.

3.3.1 Export Coal Terminal Sites

Table 3-3 presents an analysis of each of the potential coal sites in Morehead City and Wilmington with regard to the ten parameters considered to be most significant in a location decision. Table 3-4 embraces a similar parametric analysis of the 14 support base sites utilizing 13 measures of merit.

TABLE 3-3
ANALYSIS OF COAL SITES

	C-5 Southport	C-7 Sand Hill Creek	C-12 Radio Island	C-13 Marsh Island	C-14 West of Morehead
Acreage	1	1	3	2	1
Land Use	2	1	1	1	1
Rail Access	2	2	1	3	1
Access to Open Water	1	2	1	2	3
Proximity to Channel	3	3	1	3	3
Channel Depth	1	3	1	3	3
Highway Access	2	2	2	3	1
Environmental Sensitivity	2	2	1	3	1
Archeological or Historical Site	1	3	1	1	1
Competing Energy Use	2	2	3	2	1

Legend: 1-Good; 2-Fair; 3-Poor

TABLE 3-4

ANALYSIS OF OCS SUPPORT BASE SITES

	WILMINGTON									SOUTHPORT		MOREHEAD		WANCHESE
	1	2	3	4	7	8	9	10	11	5	6	12	13	15
Acreage	1	1	2	3	1	2	1	1	1	2	1	3	2	3
Land Use	3	3	1	1	1	2	2	1	1	1	2	1	1	2
Rail Access	3	2	3	3	2	2	2	1	2	2	2	1	3	3
Access to Open Water	2	2	2	2	2	2	2	2	2	1	1	1	2	3
Proximity to Channel	1	3	1	1	3	2	1	1	1	3	1	1	3	1
Channel Depth	1 38'	3 3'	1 12'	1 12'	3 1'	3 1'	2 10'	3 5'	3 5'	1 38'	1 38'	1 40'	1 12'	2 8½'
Highway Access	1	2	2	2	2	2	1	1	2	2	2	1	3	2
Environmental Sensitivity	3	3	2	2	2	2	2	1	1	1	2	1	3	3
Archeological or Historical Site	1	1	1	1	3	3	1	1	1	1	1	1	1	3
Competing Energy Use	2	1	1	1	3	2	2	2	2	1	3	3	3	1
	← 120 miles →									126 mi.		58 mi.		113 mi.
Distance to Lease Area AIR	2	2	2	2	2	2	2	2	2	2	2	1	1	2
WATER (miles)	3 155	3 150	3 144	3 144	3 146	3 150	3 155	3 160	3 163	2 136	2 136	1 62	1 62	2 131
Proximity to Airport	1	1	1	1	1	1	1	1	1	2	2	1	1	3
Proximity to Amenities	1	1	1	1	2	2	1	1	1	1	1	1	1	2

Legend:

1 - Good

2 - Fair

3 - Poor

Of the two coal sites on the west bank of the Cape Fear River, the Southport site (C-5) appears to be the more attractive because of its proximity to the shipping channel. It satisfies the need for sizeable acreage on high land, reasonable highway and rail access, and easy access to the open ocean. Conversely, the Sand Hill Creek site (C-7) is located a substantial distance from the shipping channel and would require extensive dredging. The site is more than adequate in size and would not encroach on any existing development; but would require lengthy highway and rail connections. For these reasons, the C-5 site at Southport is clearly superior.

Among the three alternative coal sites in Morehead City, the Marsh Island Site (C-13) looks least attractive for several reasons. It presently has no highway or rail access and is located on the Intracoastal Waterway with only 12 feet of channel depth. Coal would have to be transferred by conveyor or slurry pipeline to a deepwater terminal or major changes in the existing bridge and AIWW channel would be required. Of the two remaining sites, Site C-14 west of Morehead is attractive in all but one respect - it is not located on the water and would require construction of a slurry pipeline and an offshore loading terminal. Site C-12 on Radio Island, despite its limited acreage and rail access problems, probably represents the best short-term resolution to the need for a coal export terminal in Morehead City. The development of a future open storage area west of Morehead at Site C-14, with an offshore loading terminal, should not be overlooked as a future solution. It is particularly attractive from the standpoint of eliminating rail traffic through the center of the city while reducing pollution and congestion in the present port area.

3.3.2 OCS Support Base Sites

A review of the alternative OCS oil and gas onshore support base sites that are analyzed in Table 3-4 indicates that several sites satisfy the merit measures reasonably well. Initially, Site 15 in Wanchese was eliminated because its connecting channel to the open ocean is only 8½ feet deep, it has no rail and somewhat limited highway and air access, and acreage for development in the harbor area is not readily available. Project personnel then identified the following sites as worthy of more detailed investigation:

- Sites 5 and 6 in Southport
- Sites 9 and 10 in Wilmington
- Sites 12 and 13 in Morehead City

With some modifications, each of these sites could serve adequately as a support base location and each appears to have unique qualifications. The two sites in Morehead City, for example, are nearest the estimated centroid of the Northern Tract Group in lease Area 56 (Figure 2-7) and consequently have the shortest sea and air supply distances to potential OCS drilling areas. The two sites in Southport are extremely attractive because of their location immediately adjacent to the 38-foot ship channel and their proximity to the open ocean. And finally, the two sites in Wilmington have access to the best developed land and air transportation facilities and are located in a mature industrial area. Final selection will depend upon cost and availability of land, along with satisfying environmental and construction permit requirements.

3.4 Preliminary Impact Summary

After an extensive series of interviews and discussions with industry representatives and government officials, nine major energy-related projects in the Coastal Study Area (20 counties in the Coastal Zone Management Area plus seven contiguous counties) were identifed. These projects, all of which are in the proposal or planning stages, were selected for further study if they were expected to produce, utilize or transfer large quantities of energy feedstocks or products. Once the energy projects were identified and screened, energy use scenarios were developed to help determine impacts on the transportation infrastructure of the Coastal Study Area. Methodologies to be used in assessing the economic, social, environmental, recreational, and fiscal impacts of the coastal energy projects (Phase II of this study) will be identified in Part B.

3.4.1 Key Facilities Identified for Further Study

The nine major energy projects which promise, if constructed, to have the greatest impact on the Coastal Study Area and its transportation system are listed below:

	Project	Location
1.	Coal export terminals	Morehead City and along Cape Fear River
2.	BECO Refinery	Brunswick County
3.	CRDC Refinery	Morehead City
4.	LPG Terminal	Radio Island
5.	OCS Onshore Support Bases	Two sites each in Wilmington, Southport and Morehead City
6.	Aluminum Smelter	Columbus County
7.	Peat Projects	Pamlimarle Peninsula
8.	Virginia Superport Complex	South of Norfolk, VA
9.	Biomass Projects	Verona, Washington & Edenton

It should be emphasized again that this list of "major" key facilities may change as Phase II of this study is conducted.

3.4.2 Transportation Impacts

Energy use scenarios encompassing the most likely spectrum of operating conditions at each site were developed in Chapter 2. Estimates of transportation infrastructure requirements for the five subsystems - rail, highway, water, pipeline and air - were assembled in Chapter 3. An analysis of specific impacts in each of the major modes led to the following findings:

Railroads: The most heavily impacted section of the rail system in the Study Area would be Seaboard Coast Line route between Wilmington and Pembroke. In a scenario in which a coal terminal, oil refinery, and OCS support base would be constructed in the Wilmington-Southport area and an aluminum smelter in Columbus County, up to 16 million net tons of commodities could move each year on a rail line presently carrying about 6 million tons.

Under a full-development scenario for the Morehead City region in which a coal terminal, OCS support base, oil refinery, and LPG terminal would be brought onstream, up to 11 million net tons annually could be transported on Southern Railway's tracks between Morehead City and Kinston.

Highways: Principal highway impacts, in terms of number of vehicles will occur during periods of construction, although in a few cases truck deliveries of energy products may create some congestion during operation of the facilities.

Minor capacity problems may occur on service roads and entrances to the facilities under study, but the only significant capacity problem on a major route will be on US 70 at the two-lane high-level bridge joining Morehead City with Radio Island and Beaufort, where capacity problems already exist during peak traffic periods.

Water Transportation: Under the full production scenarios, an average of 5½ additional ships per week could be expected to use the port facilities in Morehead Harbor, while 8 to 12 vessels per week would be added to existing arrivals and departures in the Cape Fear River channel.

Additional barge traffic utilizing the Atlantic Intracoastal Waterway could include 8 barges in the Wilmington area, 25 in the Pamlimarle Peninsula area, and one in the Morehead area.

A small number of service and supply boats would be present in each of the major ports if an onshore supply base for OCS oil and gas were constructed.

Pipelines: Major impacts on the pipeline system would be caused by the construction of 140 to 600 miles of submarine oil and gas pipelines to serve the Northern Tract Groups of lease area 56 under a High Recovery Estimate Scenario.

Relatively short lengths of pipeline to connect the BECO and CRDC refineries with their deepwater discharging berths could impact the marine environment.

A possible coal slurry pipeline from a storage terminal west of Morehead to an offshore loading terminal would have to cross several rail and highway rights-of-way as well as environmentally sensitive areas in Bogue Sound and Atlantic Beach.

Air Transportation: Although rising passenger emplanements in Morehead City and Wilmington can be anticipated, the airlines serving these areas appear to have the capability to increase the frequency and capacity of their flights as demand increases.

An onshore support base for OCS oil and gas will undoubtedly require a helicopter base either at the support base or at an existing airport where navigation aids already exist.

3.4.3 Coal Terminal and OCS Support Base Sites

A parametric analysis of five potential sites for a coal export terminal revealed that Site C-5 in Southport and Sites C-12 (short-term) and C-14 (future) in Morehead City were the most feasible locations for a 6-to-10 million ton coal storage and export facility.

A review of 14 alternative locations for an OCS oil and gas onshore support base identified the following six sites as worthy of more detailed investigation:

Location	Site No.
Southport	5 & 6
Wilmington	9 & 10
Morehead City	12 & 13

These sites have been included in a more detailed, parallel investigation by the State Ports Authority.[4] A 3-million-ton-per-year coal facility on the existing port at Morehead City is being planned for the short run. Other sites are likely to be announced in the next few months, and current indications are that the sites listed above (C-5, C-12, and C-14) are among those being considered by the coal companies.

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[4]North Carolina State Ports Authority, "Coal Export Potential and North Carolina Ports." In-House Working Paper, September 1980.

4.0 IMPACT ASSESSMENT

The second major task during this first phase of the project is to identify the impacts and discuss the associated methodologies which will be used in Phase II to assess the impacts from the development of the major facilities previously identified. In this chapter the parameters for selecting methodologies for the assessment processes are discussed, a brief overview of existing methodologies is presented, the framework for the policy analysis of the coastal study is discussed, and the outline of the Phase II methodology is given.

4.1 Criteria for Selecting Methodologies

4.1.1 General

A methodology is defined as a sequence of steps for estimating what might happen because of the development of an energy project in the Coastal Study Area. Within the framework of this study, a methodology is viewed as a management tool, i.e., a series of procedures for estimating ahead of time what might happen and arriving at means of monitoring and developing strategies for making the development process more manageable. Several conditions must be considered in selecting the assessment process.

First, the methodology must be flexible. The variation in the scale and pace of development of the energy projects in the Coastal Study Area identified during Phase I presents several methodological problems. The Phase II research protocols must be suitable for the spectrum of identified energy projects, yet allow comparability of impact assessments between projects and a synthesis of the results across energy projects for the entire Coastal Study Area.

To expand this principle of flexibility further, impacts must be analytically separated so that impact relevant to specific energy projects can be identified and analyzed. Additionally, the unit of analysis must be geographically flexible in that the impacts of some energy projects will be limited to specific counties while other energy projects may affect the entire Coastal Study Area. Finally, the Phase II methodology must allow for both new information as it becomes available, and for variations in policy objectives. Given all this planning process should support policy decisions without committing policymakers to a course of action which will foreclose some desirable activities later on.

Second, private industry is a prime mover in the development process and any planning process must recognize industry's needs and preferences. Indeed, any development of the energy projects in the Coastal Zone depends on industrial/economic conditions at the international, national, and regional levels, as well as the state and local level.

Third, there may be no ideal location matching the energy projects and national, state, and local policy objectives due to conflict. This last condition again emphasizes the need for flexibility in the planning process to allow policy makers to arrive at optimal locational choices.

In addition to the previous considerations, a series of specific criteria for the assessment process and selection of a methodology are discussed in Sections 4.1.2 through 4.1.7.

4.1.2 Definition of Impacts

Impacts are defined as consequences of the development of transportation facilities required for the proposed energy projects. A distinction must be made between primary and secondary development.

Primary (or direct) development refers to activity specific to the construction and operation of the energy project. For OCS oil and gas, this activity would include the development and operation of OCS support bases in North Carolina, plus the transportation of feedstocks and/or product. Primary development was discussed in Chapter 2 on development scenarios.

Secondary development refers to demands created by the primary activity and include two elements: indirect development and induced development. Indirect development includes industrial projects that serve and support the primary activity. Examples would be transportation improvements needed for the movement of coal or site preparation for support bases. Induced development refers to the expansion of community services and facilities to serve the population attracted through direct and indirect development. This type of development will be examined in Phase II.

The assessment process will look at the primary and secondary development related to the respective energy projects for its impact on the transportation, economic, social-demographic, environmental, recreation,and fiscal structures of affected geographical areas. The specific methods and data needed to assess the impacts of the energy projects will be discussed in chapters 5 through 9 of this report.

It should be noted that for each of the identified areas, the assessment of impacts in Phase II involves two distinct operations. First, current conditions will be described and baseline projections (assuming no energy project is developed) will be completed. Second, impact forecasts estimating the effect of the development of the energy projects will be completed. The problems associated with each project will be detailed for each type of impact.

4.1.3 Limitations of Impact Assessment

In the assessment of impacts the focus is on identifying and forecasting changes that might occur as the result of the development of the energy projects in the Coastal Study Area. The general assessment for all energy projects will focus on the impacts of alternative modes of transportation for energy feed stocks on coastal environmental and recreational resources. The impact assessment for OCS oil and gas activity will go further including all elements of the development process.

For the potential on-shore impacts of OCS activity, the relevant timeframe includes the initial test drilling, the lease sale, and exploratory drilling through actual production and closing down the operation. In addition to the inclusiveness of the activities considered in the impact assessment of OCS activity, such assessment must include a time frame of approximately 25 years which is the expected lifetime of a commercially productive OCS oil and gas field.

For the remainder of the identified energy projects, the impact assessment will focus only on one element of the development process, i.e., the consequences of the development and operation of the transportation systems related to the energy project. For example, in the development of a coal export terminal at the Wilmington or Morehead City Ports, the assessment will focus on the consequences of using alternative transportation modes for moving the coal into and out of the respective port facilities. Additionally, the time frame for the analysis of non-OCS energy projects will be considerably shorter. With respect to OCS support bases, they are considered as a transportation facility (i.e., a terminal) for purposes of this study.

4.1.4 Ultimate Users

A central issue in the assessment process is who will use the results. The following is a list of ultimate users who have been identified:

1. North Carolina Department of Administration
    a. Division of Policy Development
    b. Office of Marine Affairs--OCS Task Force
2. North Carolina Department of Agriculture
3. North Carolina Department of Commerce
    a. State Ports Authority
    b. Utilities Commission
    c. Energy Policy Council
    d. Energy Division
    e. Energy Institute
    f. Industrial Development Division
4. North Carolina Department of Natural Resources and Community Development
    a. Office of Coastal Management
    b. Office of Regulatory Affairs
    c. Division of Environmental Management
    d. Division of Land Resources
    e. Division of Community Assistance
    f. Division of Marine Fisheries
    g. Division of Wildlife Resources
    h. Division of Forest Resources
5. North Carolina Department of Transportation
    a. Board of Transportation
    b. Systems Planning Division

c. Division of Aeronautics
d. Division of Highways

6. North Carolina State Budget Office
7. North Carolina Alternate Energy Corporation
8. North Carolina Balanced Growth Policy Commission
9. North Carolina Coastal Resources Commission
10. North Carolina Legislative Study Commission
11. North Carolina Marine Science Council
12. North Carolina Special Task Force on Hazardous Waste
13. U. S. Army Corps of Engineers
14. U. S. Coast Guard
15. U. S. Department of Commerce, Office of Coastal Zone Management
16. Bureau of Land Management
17. North Carolina County Governments in the Coastal Study Area
18. North Carolina Municipal Governments in the Coastal Study Area
19. Citizen groups involved in energy, transportation, and development-related issues in the Coastal Study Area

The impacts of interest in the assessment process will vary with the specific user. Generally the results from Phase II will aid federal, state, and local officials in planning for development and in identifying potential developments which fall under their respective jurisdictions. Specific examples of uses of the results are discussed in Section 4.4.

4.1.5 Time Frame for Assessment

Temporal considerations affect two elements of the assessment process. First, the pace of development of the specific energy projects affects the type and scope of the assessment process. The respective energy projects vary in their stage in the development process, and the length of time it will take to reach the operational stage. Additionally, our study to date has shown that various projects exhibit a great deal of flexibility in moving towards execution, a fact related to the economic climate at the time and to the review process required by national and state regulations. The BECO refinery, the aluminum plant, and the coal terminal have already been sited so that the analysis will focus on their impacts on the environmental, recreational and transportation infrastructure for the counties and municipalities involved. The OCS project is at a stage in the development process where both siting analysis and forecasting general and specific impacts will be undertaken. It would also be noted that for all energy projects the availability of data relevant to impact assessment will increase as they move toward execution and completion.

Second, the time frame of the respective projects will affect the length of time for which impacts will be forecast. OCS oil and gas activity have a potential lifetime of approximately 25 years so that estimates will be made over the entire life of the project. For the remaining projects the relevant time period for impact assessment may be shorter.

4.1.6 Generating Development Scenarios

An initial step in the assessment process is the generation of development scenarios. Scenarios represent estimates of the primary development related to a specific energy project, i.e., what might happen based on a series of assumptions concerning the energy project. The development scenario is a representation of the industry requirements in bringing a project to successful completion and as such represents the driving force for any impact assessment method. As indicated in Chapter 1, the development scenario identified to date is the "most likely" level of development as identified by industry representatives and government officials. Lower and higher ranges of development levels will be identified in Phase II.

The intitial scenarios developed for the energy projects also indicated the existence of a range in the quality of information used to develop the scenarios. The assumptions concerning the coal terminal scenario are based on a knowledge of the availability of steam coal, the existence of a transportation system, the demands on the transportation system, and the markets the coal terminal will serve. In contrast, the assumptions for the OCS scenario are based on estimates of the total recoverable reserves of oil and gas, estimates which are tentative at this point. Therefore, as part of the flexibility of the methodology, the development scenarios will be periodically updated based on new data which become available as the study progresses. Relevant environmental impact statements will be one source of such data on the scope of the energy projects.

The generation of the scenario for OCS activity is at once the most difficult due to the uncertainty concerning the resources actually present, and the most important due to its potential impact in a frontier area for oil and gas activity. An indicator of potential recoverable reserves will be used to estimate the industry activities and facilities likely to take place and which form the basis for siting analysis and forecasting general and specific impacts. The methodology used for assessing OCS activity will be iterative to allow periodic updates of the industry activities and facility needs.

4.1.7 Areal Units for Impact Analysis

The geographical unit for the impact analyses varies according to the perspective of the ultimate user. Possible units of analysis include the South Atlantic region, the state, the Coastal Study Area, the regional councils of governments (multi-county planning regions), and counties and municipalities in which the specific energy projects are located. In choosing the unit of analysis it must be noted that specific projects may have little impact on the region or state, yet have considerable impact on the multi-county planning region, county or municipality in which it is actually located. The latter is particularly true in non-metropolitan areas. It is proposed that the impact assessment focus on both general impacts for the state and Coastal Zone Study Area, and the specific impacts for the counties and municipalities in which the respective projects are located.

4.2 Overview of Assessment Methodologies

The criteria discussed in the preceding section will guide the selection of elements used in assessing the impacts of energy project development in the Coastal Study Area. A review of the existing methodologies indicates that a complete package - including generating development scenarios, siting analysis, and forecasting general and specific impacts - can only be developed by combining elements from two or more methods. Methods which have been identified are those developed by New England River Basin Commission (NERBC), Roy F. Weston, Inc. (WESTON), the Conservation Foundation (CF), and Maryland's Major Facility Study (MARYLAND). Although the WESTON methodology will be relied on most heavily in this study, a brief overview of each method follows.[1]

4.2.1 The WESTON Methodology

The WESTON Methodology offers a comprehensive approach to estimating offshore and onshore OCS activity, and a general assessment of the full range of impacts related to energy project development. It provides alternate methods of assessing environmental, economic, social-demographic, and fiscal impacts ranging from relatively simple to detailed analysis. The strength of the WESTON methodology is that it integrates the imputs and outputs from separate impact assessment methods. The weakness of the WESTON approach is that it does not provide a method of assessing specific impacts. However, its strength is that the impact assessment methods can be applied to energy projects other than OCS development. Elements of the WESTON approach can be combined with other methodologies to provide a stronger overall methodology.

4.2.2 The New England River Basin Commission Methodology

The New England River Basin Commission (NERBC) research project is specifically related to OCS activity. The project includes methodologies 1) to estimate offshore activities associated with OCS oil and gas development, 2) to estimate onshore facilities associated with OCS oil and gas development, and 3) to identify the site, and then conduct impact analysis. The research and planning activities in the NERBC methodologies are intended to be used in anticipation of actual development. The methodologies represent separate components that can be used in conjunction with other methods. The NERBC approach provides a strong approach to general siting analysis but it is weak in providing specific siting analysis and specific impact analysis. For present purposes the

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[1]See a more detailed discussion in several selected references listed in Appendix B.2.8, particularly Bish, NERBC, and Weston.

This study only deals with onshore impacts of OCS activity and other energy development activity.

NERBC approach would have applicability for the OCS portion of the research in combination with other methodologies.

4.2.3 The Conservation Foundation Methodology

The Conservation Foundation (CF) methodology was developed to help Fish and Wildlife Service field biologists in commenting on the OCS leasing process and reviewing specific proposals for onshore facilities and activities. The CF approach provides the strongest method for assessing the environmental impacts of primary and secondary development. Its weakness is in the generation of development scenarios, siting analysis, and specific socio-economic impact assessment.

4.2.4 The Maryland Methodology

The Maryland Major Facility Study examines the interface between the needs of OCS and non-OCS facilities and the suitability of specific geographical areas. The MARYLAND approach offers a "conflict resolution" methodology for competing facilities and as such will be used to look at the existing and proposed energy projects in the Coastal Zone Area. The strength of the MARYLAND approach lies in its detailed siting analysis and the completeness of its assessment of specific socio-economic impacts. The weakness of the MARYLAND approach is in the generation of development scenarios and the assessment of general impacts.

4.3 Identification of Policy Framework

An integral part of the Phase II research effort will be the identification of the policy framework affecting energy project development in the Coastal Study Area. Two reasons for the policy framework review are suggested in the NERBC Methodology (1978b). First, such a review is necessary to identify the extent to which development in certain areas is prohibited by law. Second, the examination can form the basis for a review and revision of existing institutional mechanisms necessary for managing energy project development. The intent of the analysis is to identify the laws, regulations, policies, and plans which may affect the development process, not to examine how effectively they are administered or how successful they are in guiding development.

The specific purposes of the policy analysis in the Phase II research effort are for the siting analysis of OCS support bases, and the identification of mitigation procedures that may become necessary due to unavoidable losses resulting from the impacts of the energy projects' development. Impacts of interest include economic, social-demographic, fiscal, environmental, and recreational impacts, with particular emphasis on the last two. Such losses will be identified in the impact forecasts and the ongoing monitoring during the duration of the Phase II research effort.

Federal, state and local policies, regulations, and plans will be examined to determine what, if any, effect they may have on the siting and development of the energy projects and the mitigation of losses in the Coastal Study Area. An overview of the federal regulatory framework as applicable to OCS oil and gas activity has been done by the Conservation Foundation (1978, Vol. IV). This is the only energy-related program area for which such a plethora of literature on the subject exists.

An inventory of federal agencies whose responsibilities, policies, regulations, and plans will be examined in the policy analysis are listed below:

1. Department of Energy
2. Department of the Interior
   a. Bureau of Land Management
   b. U.S. Geological Survey
   c. U.S. Fish and Wildlife Service
   d. National Park Service
3. Department of Commerce
   a. Office of Coastal Zone Management
   b. National Oceanic and Atmospheric Administration
   c. National Marine Fisheries Service
4. Department of Defense-Army Corps of Engineers
5. Department of Transportation
   a. U.S. Coast Guard
   b. Federal Highway Administration
   c. Federal Railroad Administration
   d. Federal Aviation Administration
6. Council on Environmental Quality
7. Environmental Protection Agency
8. Federal Energy Regulatory Commission

9. Synthetic Fuels Corporation
10. Coastal Plains Regional Commission (Federal-State partnership)

A list of state agencies with responsibilities applicable to development of the energy projects in the Coastal Study Area, whose policies, regulations, and plans will be examined, was provided in the discussion of ultimate users of this research (see Section 4.1.4). The major statement of the state regulatory framework applicable to this research is the North Carolina Coastal Management Plan, Amended (1978).

Additionally, local policies, regulations, and plans of the counties and municipalities in the coastal study area will be examined for their applicability to the development of the energy projects and possible mitigation procedures.

The initial analysis of the federal, state, and local policy framework affecting development will be completed in Phase IIA and will focus on the siting analysis for OCS support bases. Monitoring of the policy framework for the Coastal Study Area will continue throughout the project.

4.4 Impact Assessment in Phase II

Sections 4.1 and 4.2 briefly described the issues and limitations of impact assessment and reviewed the methodologies available. The present discussion will focus on the interrelationships between the analytical elements of the impact assessment process that will be detailed in subsequent chapters. The execution of these several units is the main focus of Phase II.

The total impact of the relevant energy projects on the coastal study area is the sum of the economic, social-demographic, recreational, environmental and fiscal impacts of transportation services for the respective energy projects. The analyses of impacts are separated to better state the relevant variables, the interrelationships between variables, and the data needed for the analysis. While the objectives, methods, and data for each impact analysis unit are detailed in subsequent chapters, the purpose here is to provide a broad overview of the way the Phase II research will progress and the interrelationships between the analytical units.

Consistent with the intent of the impact analysis discussed in Sections 4.1.2 and 4.1.3, two flow charts are provided to illustrate the research process in Phase II. Figure 4.1 describes the impact analysis for OCS oil and gas activity (Phase II-A). Industry needs, predicated on alternative estimates of recoverable oil and natural gas off the North Carolina coast are used to forecast the probable economic, social-demographic, recreational, environmental, and fiscal impacts of the development process, with specific emphasis on industry needs for on-shore support base sites. This study will deal only with this subset of industry needs, not all OCS impacts.

Figure 4.2 illustrates the impact analysis for non-OCS energy projects (Phase II-B). Although the framework for OCS and non-OCS projects is similar, the particular emphasis in the non-OCS energy projects will be on the industry's transportation and storage requirements and the impact of those needs on the environment and on the recreational activity. For the non-OCS energy projects the other impacts (economy, social-demographic, fiscal) will be reviewed for their relationship to the environmental and recreational impacts. Transport requirements are derived from industry requirements.

The logic of the impact analysis in Phase II is essentially the same for both categories of energy projects, because the analyses are dependent on industry requirements and the locations of the projects. Figures 4.1 and 4.2 indicate that the output from one impact analysis unit serves as input for other analysis units. Additionally there are feedbacks within the analysis.

The impact analyses in Phase II involve several goals. The first task will concern base line data forecasts that will describe present conditions, identify existing data gaps, and forecast future conditions without the energy projects (see Work Plan in Appendix B.1. Second, the Phase II research will forecast what development might occur in alternate transport modes as the result of the energy projects. The

Figure 4.1. General Flow Chart for Impact Analysis of OCS Oil and Gas Activity

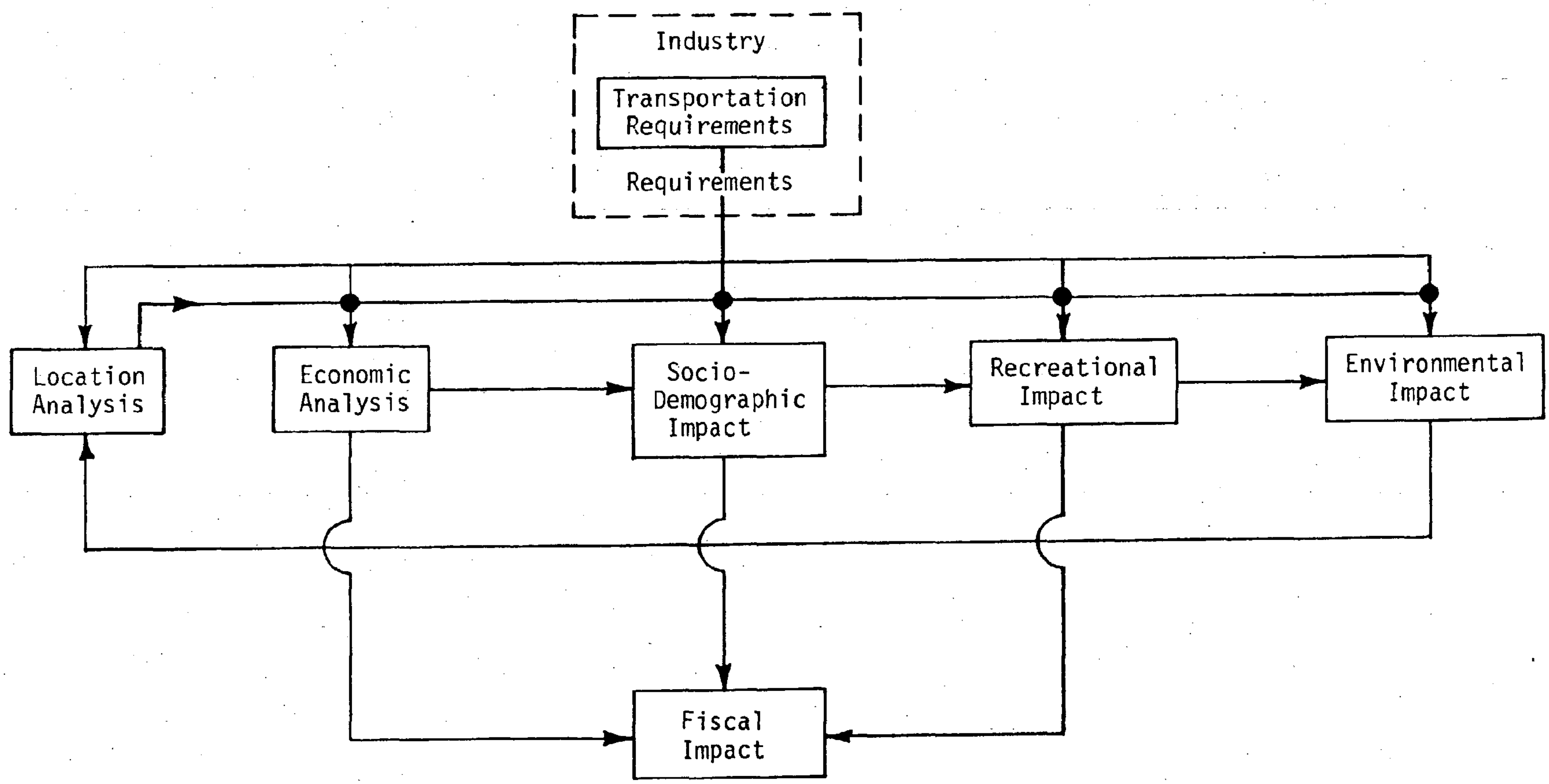
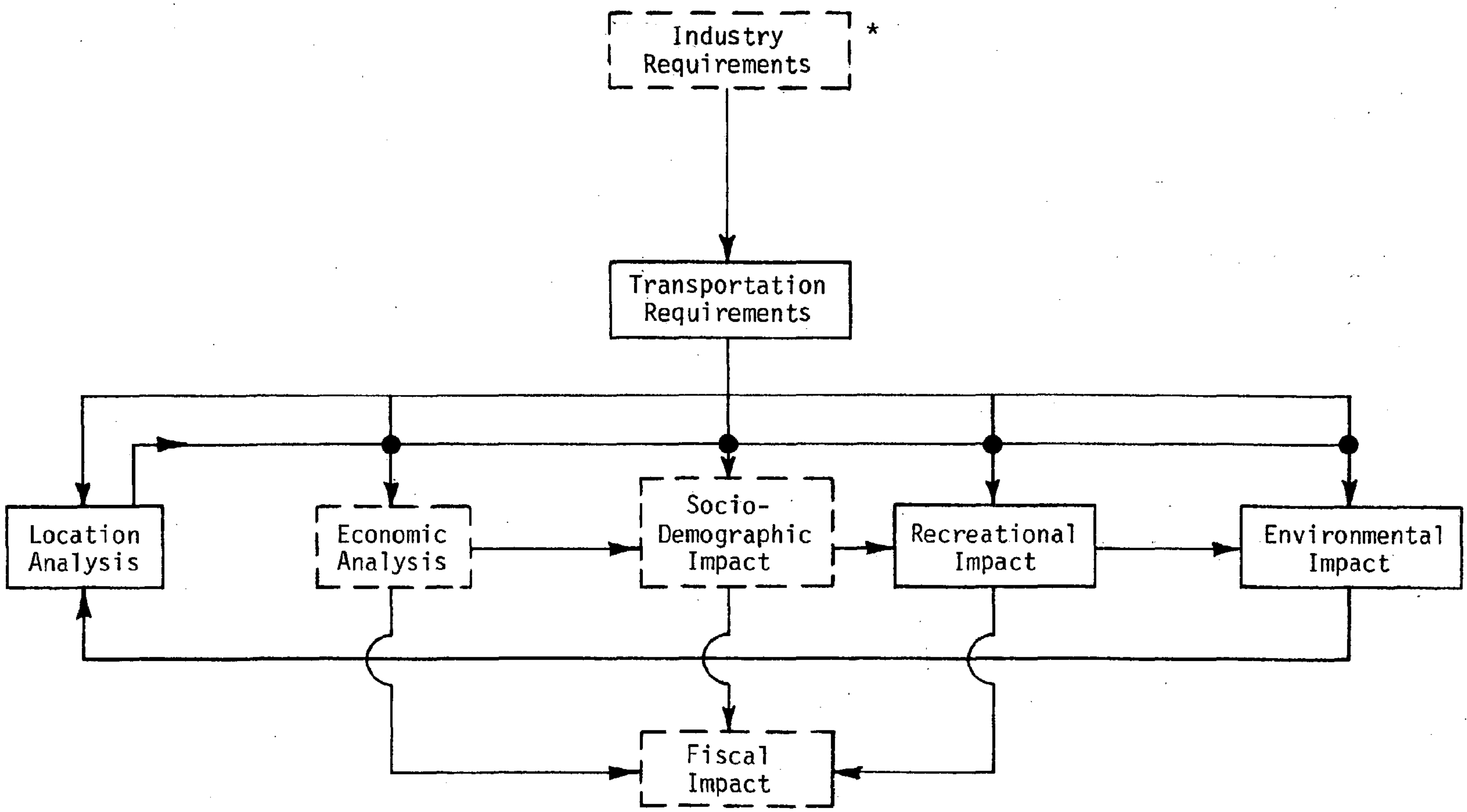


Figure 4.2 General Flow Chart for Impact Analysis of Non-OCS Energy Projects



*Dashed-line boxes represent tasks that will only indirectly be considered in the impact assessment.

estimation of energy project development impacts will come from comparison of the base line forecasts and the energy projects development forecasts.

Third, the Phase II research will allow us to identify the relative importance of the potential impacts and suggest mitigating actions which may be necessary. Finally, the specification of impacts and the necessity for mitigating action will be placed in the context of the policy framework for the Coastal Study Area.

In the following chapters the specific objectives of each impact analysis unit will be discussed. The relevant variable and data sources will be described, the specific methodologies to be used for the base line and impact forecasts will be identified, and the output of the analyses will be discussed. The WESTON methodology will form the basis for most of Phase II work.

5.0 ECONOMIC IMPACTS

5.1 Definition

The assessment of the economic consequences of development involves two operations. The first step involves the description of present economic conditions and the development of forecasts of future economic conditions without the effects of the energy projects. The second operation involves the impact forecasts describing future economic conditions with the development of the energy projects. The impact forecasts must deal with economic effects corresponding to both primary and secondary development.

5.1.1 Primary Economic Impacts

Economic impacts resulting from primary development are the changes in employment and income due to the construction and operation of the energy projects (Coastal Environments, Inc. 1976). The basic input for forecasting primary economic impacts comes from the industry requirements which must be quantified from the development scenarios for the respective energy projects.

For OCS oil and gas activity the initial industry requirements will be constructed from alternative estimates of recoverable oil and gas resources from Lease Sale 56, i.e., the low, medium, and high resource recovery scenarios. Primary employment and economic effects related to the OCS development scenarios will cover the construction and operation of a number of onshore facilities during the life of project (NERBC, 1977). Due to the tentative nature of the estimates of recoverable oil and gas resources at the present stage of OCS activity, the development scenarios and the estimates of subsequent primary economic effects will be periodically updated to reflect new information on the recoverable resources.

For the non-OCS energy projects, the pertinent initial industry requirements for estimating primary economic impacts are the employment and income changes that will be generated by the construction and operation of transportation systems for the respective projects. For the coal export terminals, primary development will include increased rail traffic to move coal to the port facilities and increased ship traffic to move the coal from the port facilities. Development of the non-OCS energy projects will be monitored to periodically update the development scenarios and changes in the relevant transportation needs.

5.1.2 Secondary Economic Impacts

Economic impacts resulting from secondary development are the changes in employment and income due to indirect and induced development in response to the primary activity. Indirect development includes employment resulting from necessary support services which are not directly hired jobs by the primary development, which may be contracted directly and are often subcontracted. Indirect employment would also include major suppliers to primary field operations (Coastal Environments, Inc., 1976). Indirect employment is usually derived from estimates of primary or direct employment by applying a ratio based on other experience in the same industry or experience in the same region. Specific factors which may influence the level of indirect employment include the scale of development indicated by the development scenarios, the presence of established support services in the study region, and the availability of such services in other areas nearby (Conservation Foundation, Vol. II, 1978).

Induced employment is generated by the initial and subsequent rounds of spending and wages earned by direct and indirect employees who reside within the regional economy of the study area (Coastal Environments, Inc., 1976). Induced employment is the most diverse of the three employment concepts and will include doctors, school teachers, policemen, and store clerks. Typically, induced employment is estimated by applying a multiplier to the total for direct and indirect employment. Choice of the multiplier is based on the size of the region, the presence or absence of needed facilities and services in the region, and the availability of needed facilities and services in adjacent regions (Conservation Foundation, Vol. II, 1978).

Two additional considerations that form the context for the economic impact analysis are the determination of the region of impact and the time frame for the impact analysis.

The areal unit used for the economic impact analysis depends in part on the level of detail desired and the extent to which the respective energy projects can be accurately located. For the non-OCS energy projects, the sites for development have been largely determined so that the analysis will look at the specific counties in which the activity is located.

For the OCS oil and gas activity, the location of onshore facilities is itself a matter of study, and the siting analysis will serve as an input to define the area for economic impact analysis. Using the location analysis general economic impacts will be forecast. Specific economic impacts of OCS development are not practical in terms of time and effort until specific proposals for development exist. An important research note is that the region of impact is related to the economic perspective of the methodology, a point which will be elaborated in subsequent sections.

The time period for the analysis consists of the period from the most recently available data to the most distant data desired. The latter can be determined by the policy planning horizon of the ultimate users. The time period for forecasts of economic impacts will vary according to the specific energy project being considered.

5.2 Baseline Economic Forecasts

In order to have a basis for comparisons of development after the energy projects are developed, it is necessary to establish a baseline forecast representing existing estimates of economic growth for a region without the development of the specific energy projects being studied. One set of baseline economic projections will be used for estimating impacts for each of the proposed energy projects.

The WESTON approach (Weston, Vol. II, 1978) uses a methodology based on the OBERS Projections, Bureau of Economics Analysis, US Department of Commerce. The OBERS projection procedure produces a set of national projections first, then distributes these projections regionally based on previous regional contributions to the national total. The WESTON methodology calls for updating the estimates by comparing the values for employment and income projected by the OBERS projections with those which would have been forecast with the OBERS methodology and more recent data. OBERS geographical units include states, Bureau of Economic Analysis regions, water resource regions and standard metropolitan statistical areas (SMSA).

With the exception of the Wilmington SMSA, the geographical area of interest in the Coastal Zone Area of North Carolina does not correspond to the OBERS units of analysis. To modify the OBERS forecasts to the counties of Coastal Zone Area, available data for the counties will be used to construct ratios for allocating the OBERS projections to the relevant counties.

The OBERS projections provided estimates of population, employment, personal income, and earnings by industry, both historical and projected (1950-2020), for the geographical areas identified above. Additionally, these projected data are used to estimate baseline values on occupational distributions and resource use -- energy and water use, sewers, land use, use of extractive minerals, financial capital markets, and physical infrastructure.

An important qualification should be made in relation to the baseline forecasts. In general, the larger the area for which the projections are made, the more accurate will be the projection. This variation in accuracy is related to the inability to deal with random economic fluctuations for small areas which tend to have cancelling effects for larger regions. Given this fact the baseline projections will be done for the Coastal Zone Study Area.

5.3 Estimating Economic Impact Values

As mentioned previously, the estimates of economic impacts are developed from the values generated in the development scenarios. Specifically, the industry requirements identified in the development scenarios will be used as the input for estimating impact values. As discussed in Chapter 4 several methodologies exist for estimating economic impacts. The most applicable to the present research effort are the WESTON (Weston, Vol. II, 1978) and MARYLAND (Rogers and Golden, Inc., 1977) approaches. The major difference between the two approaches is their respective level of specificity. The WESTON approach is directed toward measuring general impacts while the MARYLAND approach is directed toward measuring specific proposals for siting facilities exist. For the present study, particularly for OCS oil and gas activity, the economic impact analysis will focus on general impacts.

A first step in the estimation of economic impacts is the conversion of the physical requirements into economic terms. The WESTON approach (Roy F. Weston, Inc., Vol. II, 1978), provides a methodology for converting the physical requirements of OCS activity into economic output price units. This output is then used to generate the primary, indirect, and induced employment related to development.

The WESTON approach suggests three models which can be used to generate the estimated impacts: the Curtis Harris model, the RIMS model (Regional Industrial Multiplier System), and an alternative WESTON methodology. The methods differ in their levels of complexity, required inputs, and costs (Roy F. Weston, Inc., Vol. II, 1978). The present study will use the WESTON methodology for the forecast of general impacts for development.

5.4 Data Sources and Analysis Procedures

In Phase II, the data that serve as inputs in the forecasting of economic impacts will come from two sources. First, the base line economic data for establishing present conditions and forecasting future conditions without energy project development will come from secondary sources. Second, the data for the initial estimation of primary development will be derived from the authors' estimates in the development scenarios (See Chapter 3).

Table 5.1 identifies the data needs, data sources, methodologies to be applied and outputs for the Phase II economic base line and impact forecasts. Throughout the Phase II research, data sources will be monitored to make use of the most recently available data. This includes updating the development scenarios as applicable and using new economic and population data as they become available.

TABLE 5.1

INPUT VARIABLES, DATA SOURCES, PROCEDURES/METHODOLOGIES, OUTPUT VARIABLES FOR ECONOMIC ANALYSIS

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
1. **Total population**	U.S. Dept. of Commerce, OBERS Projections & Statistical Abstract of United States	WESTON Methodology: Chapter 3, Sections 3 & 4; WESTON: Chapter 4	Baseline and impact forecasts of population
2. **Total personal income**	U.S. Dept. of Commerce, OBERS Projections & Survey of Current Business	WESTON Methodology: Chapter 3, Sections 3 & 4	Baseline and impact forecasts of personal income
3. **Total employment**	U.S. Dept. of Commerce, OBERS Projections & County Business Patterns	WESTON Methodology: Chapter 3, Sections 3 & 4	Baseline and impact forecasts of total employment
4. **Earnings by industry**	U.S. Dept. of Commerce, OBERS Projections & County Business Patterns	WESTON Methodology: Chapter 3, Sections 3 & 4	Baseline and impact forecasts of earnings by industry
5. **Earnings per employee ratios**	U.S. Dept. of Commerce, Survey of Current Business	WESTON Methodology: Chapter 3, Sections 3 & 4; used to calculate employees by industry	Baseline and impact forecasts of employment by industry
6. **Family income distribution projections**	National Planning Association, "Regional Projections"	WESTON Methodology: Chapter 3, Section 3 & 4; used to attribute income to population groups	Baseline and impact forecasts of family income distributions

TABLE 5.1 (cont'd)

	Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
7.	Resource use ratios	WESTON, Chapter 3, Section 3; Council on Environmental Quality, MERES: Matrix of Environmental Residuals for Energy Systems	WESTON Methodology: Chapter 3, Sections 3 & 4	Baseline and impact forecasts of demand for sewer, water, public services, etc.
8.	Industry requirements of OCS oil and gas	OCS development scenarios (see Chapter 3); U.S. Dept. of Interior, DEIS Lease Sale No. 56	WESTON Methodology: Chapter 3, Section 4; used for impact forecasts	N.A.
9.	Transportation requirements for non-OCS energy projects	Non-OCS transportation scenarios (see Chapter 3)	WESTON Methodology: Chapter 3, Section 4; used for impact forecasts	N.A.
10.	Input-output multiplier model	WESTON, Chapter 3, Appendix A & Appendix B	WESTON Methodology: Chapter 3, Section 4 Used to estimate impact secondary employment	N.A.

6.0 SOCIAL-DEMOGRAPHIC IMPACTS

6.1 Purpose and Theoretical Basis

The purpose of the socio-demographic impact assessment is to measure changes in the size and composition of the population. Two forecasts will be made, i.e., a baseline forecast assuming no energy project development, and an impact forecast which includes the effects of development.

Changes in the demographic make-up of a population are prime indicators of social-structural, social-environmental (as opposed to physical-environmental) and technological change in a society (Kasarda 1977, Hawley 1971). When macro-level data, (data gathered on a level other than that of an individual - county or state rates for example) are entered into the decision making process along with micro-level or attitudinal data a successful methodology for assessing impacts will result.

In analyzing change and stability in social systems it is useful to rely on Duncan's[1] four reference variables: (1) population, (2) organization, (3) environment (social and physical and (4) technology. As Kasarda stated, the definitions for these terms are broad but useful, if for no other use than a heuristic one. Population, then, refers to a collectivity of people that act in a structured, repetitive manner.

Organization refers to social structure. It is an intrinsic attribute of a collectivity, only analytically distinguishable from population, and primarily refers to the network of relationships that arise due to (1) structural differentiation and integration of functions (as in a corporation), and (2) supplementary similarities (as in a labor union).

Environment is the least conceptualized variable in the set and is simply considered to be anything external to the population under study.

[1]Duncan, O. D., "Human Ecology and Population Studies". The Study of Population. Editors: Phillip Hauser and O. D. Duncan, Chicago. Chicago Press, 1959. pages 678-716.

Technology refers to the set of artifacts, tools and techniques employed by a population to obtain sustenance from its environment and to facilitate the organization of sustenance-producing activities (Duncan 1959: 682). Because population, organization, environment and technology are interdependent, a permanent and/or massive change in one, as in OCS development, will result in alterations and equilibrations in the other three.

As change has been accumulating over time, the demographic/sociological perspective as espoused by Kasarda, Duncan, Sly, Lenski and others is especially applicable for an understanding of the process of change and particularly expansion. Briefly stated

> ...expansion is a process of cumulative change whereby growth of a social system is matched by a development of organizational functions to insure integration and coordination of activities and relationships throughout the expanded system (Kasarda 1977:15).

6.2 Definition of Social-Demographic Impacts

Investigations of baseline demographic and attitudinal data and extrapolations garnered from such an enterprise, when linked to an appropriate theoretical framework, provide a valuable input for policy makers' decisions on potential impacts. How many new schools will be needed? How will public services such as police, fire, and health care be affected? How will available land be used? Will the population welcome or discourage development?

The population variables to be examined include age, sex, and racial-ethnic composition, educational attainment, household characteristics, population density, population distribution, and migration patterns. Baseline projections will describe the present demographic situation in terms of the preceding variables and forecast what might happen in the future without the development of the respective energy projects.

Forecasts of impacts will estimate what might happen with the development of the energy projects. The inputs for the social-demographic impact assessment include the primary employment generated by the energy project and the secondary employment (indirect and induced employment) that results from the energy projects. Total new employment related directly or indirectly to the energy projects must be adjusted to measure the total new population (Conservation Foundation, 1978, Vol. II).

Some new employment will absorb the existing labor force, e.g., the previously unemployed or workers switching jobs. Additional workers will enter the population on a temporary basis, e.g., construction workers. Finally, some new workers will enter the local labor force on a permanent basis, becoming new resident employees. New resident employees will be further categorized into those with and without families. The number of new resident employees with families will be adjusted to take into account average family size.

The development-related employment will be translated into housing demand and associated services, school enrollment, infrastructure requirements and community services such as recreation.

6.3 Categories of Analysis Variables

The specific methodology for the baseline and impact social-demographic forecasts depends on the specific energy project as well as its scale, scope, and timing. A socio-economic impact assessment of any project would include:

(1) Inventory of current conditions/infrastructure.

(2) Projections of employment (see Chapter 5).

(3) Specific impacts of the construction phase.

(4) Housing impacts and needs.

(5) Impacts on public services, private businesses, land use and quality of life.

(6) Evaluation of planning and management systems.

(7) Recommendations for planning, organizing and controlling land use and financing.

(8) Description of the population - migration rates, population estimates, economic indicators of individuals as well as prospective community impacts such as crime rates, alcoholism rates, etc.

(9) Community attitudes.

Data would be gathered from a variety of sources: (1) census publications, (2) projections based on industry estimates of the proposed level of activity (see Chapter 2), (3) the use of Delphi techniques utilizing key informants so as to cull well informed, impressionistic views of the effects of the projects, and (4) the use of mini-surveys. As Finsterbusch (1976) stated,

> mini surveys (sample sizes from 20 to 80) are ideally suited to the needs of social impact assessment (SIA). They are inexpensive, quick, easy to conduct and often enormously informative. They cannot produce a high degree of certainty, however SIAs have different data requirements than research articles for the social science community....they seek to provide information for choosing among policy alternatives....minisurveys may be sufficient for deciding between policy alternatives even though high levels of certainty are not obtained.

Creation of scenarios based on the above techniques will provide the initial step in a comprehensive methodology and assessment. By using historical trends and present assumptions, calculations provide estimates of the scale and timing of activities, facilities and impacts - positive as well as negative.

6.4 Data Sources and Methodologies

The WESTON methodology (1978) provides the best-organized approach to the baseline and impact social-demographic forecasts. Alternative projection methodologies include: (1) the OBERS projections for states, SMSA's and non-SMSA counties, (2) the EMPIRIC Activity Allocation Model, and (3) The PLUM Incremental Projective Land Use Model. County projections done by the North Carolina Division of State Budget and Management (1978) will be used as a check on the baseline and impact projections.

In Phase II the data that serve as inputs in the forecasting of socio-demographic impacts will come from two sources. First, the baseline socio-demographic data for establishing present conditions and forecasting future conditions will come from secondary sources. Second, the data for estimating socio-demographic impact conditions will come from the economic analysis section.

Table 6.1 identifies the data needs, data sources, the methodologies to be applied and data outputs for the Phase II socio-demographic baseline and impact forecasts. Throughout Phase II research, data sources will be monitored to periodically update the relevant data base.

TABLE 6.1

INPUT VARIABLES, DATA SOURCES, PROCEDURES/METHODOLOGIES, AND OUTPUT VARIABLES FOR SOCIAL-DEMOGRAPHIC ANALYSIS

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
1. Age distribution	U.S. Census Bureau, Projections of the U.S. By County and Age & Statistical Abstract of the U.S.	WESTON Methodology: Chapter 4, Section 1; Shyrock & Siegel (1973): pp. 214-215, 234-236	Baseline and impact forecasts of age structure
2. Sex composition	U.S. Census Bureau, Census of Population & County and City Data Book	WESTON MethodologyL Chapter 4, Section 1; Shyrock & Siegel (1973): pp. 191-199, 236-243	Baseline and impact forecasts amd sex composition
3. Racial and ethnic composition	U.S. Census Bureau, Census of Population, General Population Characteristics	Shyrock & Siegel (1973): pp. 191-199, 236-243	Baseline and impact forecasts of racial composition
4. Educational attainment	U.S. Census Bureau, Census of Population, General Social and Economic Characteristics	WESTON Methodology: Chapter 4, Section 1, Shyrock & Siegel (1973): pp. 313-336	Baseline and impact forecasts of educational composition
5. Household Characteristics	U.S. Census Bureau, Census of Population, General Population Characteristics & City and County Data Book	WESTON Methodology: Chapter 4, Section 1, Shyrock & Siegel (1973): pp. 100, 307-310	N.A.

TABLE 6.1 (cont'd)

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
6. Population density	U.S. Bureau of Census, Statistical Abstract of the U.S. & County and City Data Book	WESTON Methodology: Chapter 4, Section 1, Shyrock & Siegel (1973): pp. 133-135, 156-159	Baseline and impact forecasts of population density
7. Population change	U.S. Bureau of Census, Statistical Abstract of the U.S. & County and City Data Book	WESTON Methodology: Chapter 4, Section 1, 2, 3; Shyrock & Siegel (1973): pp. 373-388; used to make baseline and impact forecasts	N.A.
8. Migration patterns	U.S. Census Bureau, County and City Data Book & Current Population Reports	WESTON Methodology: Chapter 4, Section 1; Shyrock & Siegel (1973); pp. 605-645, 791-793; used to estimate new residents	N.A.
9. Population location and distribution	U.S. Census Bureau, County and City Data Book, Statistical Abstract of U.S.	WESTON Methodology: Chapter 4, Section 1; Shyrock & Siegel (1973); pp. 45-47, 59-61, 392-393, 119, 123	Forecast geographical distribution of population, maps of population distribution
10. Urbanization rates	U.S. Census Bureau, County and City Book & Current Population Reports	WESTON Methodology: Chapter 4, Sections 1, 2, 3; used to estimate changes in residence patterns for forecasts	N.A.
11. Total employment	Baseline and impact economic forecasts (see Chapter 6)	Used to drive the social-demographic forecasts	N.A.

7.0 ENVIRONMENTAL IMPACTS

7.1 Definitions of Environmental Impacts

The objective of the environmental impact assessment is to identify and describe the changes in the environmental systems of the Coastal Study Area resulting from changes in the transportation infrastructure required to support the proposed energy projects. The analysis proceeds by producing baseline forecasts of future environmental conditions without the energy projects development. The second step is to develop impact forecasts which include estimates of the environmental effects of the transportation requirements for project developments. Finally, mitigating actions are analyzed.

Special problems exist in analyzing environmental impacts. As stated in A User's Guide to Assessment Methods (U.S. Dept. of Interior, 1978):

> Forecasting environmental impacts is difficult prior to specific facility proposals, for the character and condition of the size of facilities is an important in determining impact as the effects of the facility itself. These forecasts are more general than those for socio-economic impacts, where employment and income, for example, are projected regionally (Dept. of Interior, 1979:19).

The focus in the environmental analysis is on changes in the physical environment and/or changes which result from man's use of that environment. If either of these conditions is met, then the result can be termed an impact. The analysis focuses on projects, the activities associated with that project, the disturbances or alterations to the physical environment, and the effects or impacts that these alterations have (Conservation Foundations, 1978:Vol. II). For example, the construction of a marine terminal for OCS activity involves dredging, bulkheading, land clearing, and general construction. These activities lead to disturbances such as discharge of spoil, which in turn produces disturbances such as turbidity and sedimentation (Conservation Foundation, 1978:Vol. II). The preceding analysis indicates how environmental analysis is tied to specific locations since the analysis of disturbances depends on specific physical conditions.

The environmental systems considered include geology, biology, land use, aesthetics, recreation, and air and water quality (Roy F. Weston, Inc., 1978:Vol. II). A limitation in the environmental analysis is the difficulty in quantifying the above mentioned systems; quantification is necessary for measuring changes. This condition will make environmental analysis more qualitative than the analyses for other types of impacts.

7.2 Selection of Analysis Procedures

The purpose of the WESTON methodology is to understand the types and extent of OCS activities and choose among sizes. The methodology is linked to location analysis as well as demographic and economic analysis and focuses on the short-term, direct impacts of the proposed facility on the area immediately surrounding it. The WESTON framework for an OCS-related environmental impact assessment report contains three steps (Roy F. Weston, Inc., 1978:Vol. II):

Step 1: Establish the Baseline condition of the study area.

- Define the study area (utilizing location analysis procedures).
- Detail the environmental systems of study area: Geology, Biology, Land use, Aesthetics, Recreation, Air and Water Quality, etc.

Step 2: Describe expected future conditions without the proposed development.

- Estimate rate of population growth, and expected industrial or commercial development (in part from economic analysis inputs).
- Create and use suitable map overlays, with possible changes.

Step 3: Develop environmental impacts <u>with</u> development on the major steps.

- Establish the projects to be located in the study area (in part from location analysis inputs).
- Define the project activities. Affix them to a stage in the entire development scenario.
- Develop environmental impacts by one of three WESTON analytical techniques: (a) question analysis (generally for smaller projects with moderate impacts) (b) matrix analysis (for medium-sized projects with a high probability location) and (c) optimum pathway matrix analysis (for the comprehensive computer based treatment of large-scale projects with significant environmental impacts). Information on the impacts of site alteration and the discharge of residuals is incorporated in the NERBC's factbook.

The WESTON approach provides an analytical flow chart as part of its environmental impact analysis. Figure 7.1 is presented as a device for organizing the described steps. The WESTON "question analysis approach" to environmental analysis will be used in Phase II (Roy F. Weston, Inc., 1978:Vol. II).

7.3 Data Sources and Methodologies

The data needs for the environmental analysis include an inventory of baseline conditions; projected growth without the development of energy projects built on the baseline economic and demographic analysis to be done in Phase II (See Chapters 5 and 6), and the activities and growth tied to the development of the energy projects built on the industry requirements analysis (see Chapters 3, 5, and 6). Secondary sources of data will be used for information specific to the environmental analysis in addition to the output from other sections of the Phase II research.

Table 7.1 describes the input variables, data sources, methodologies to be applied, and the output information for the environmental analysis. Information sources will be monitored to periodically update environmental estimates. An initial inventory of environmental concern is shown in Figure 7-2.

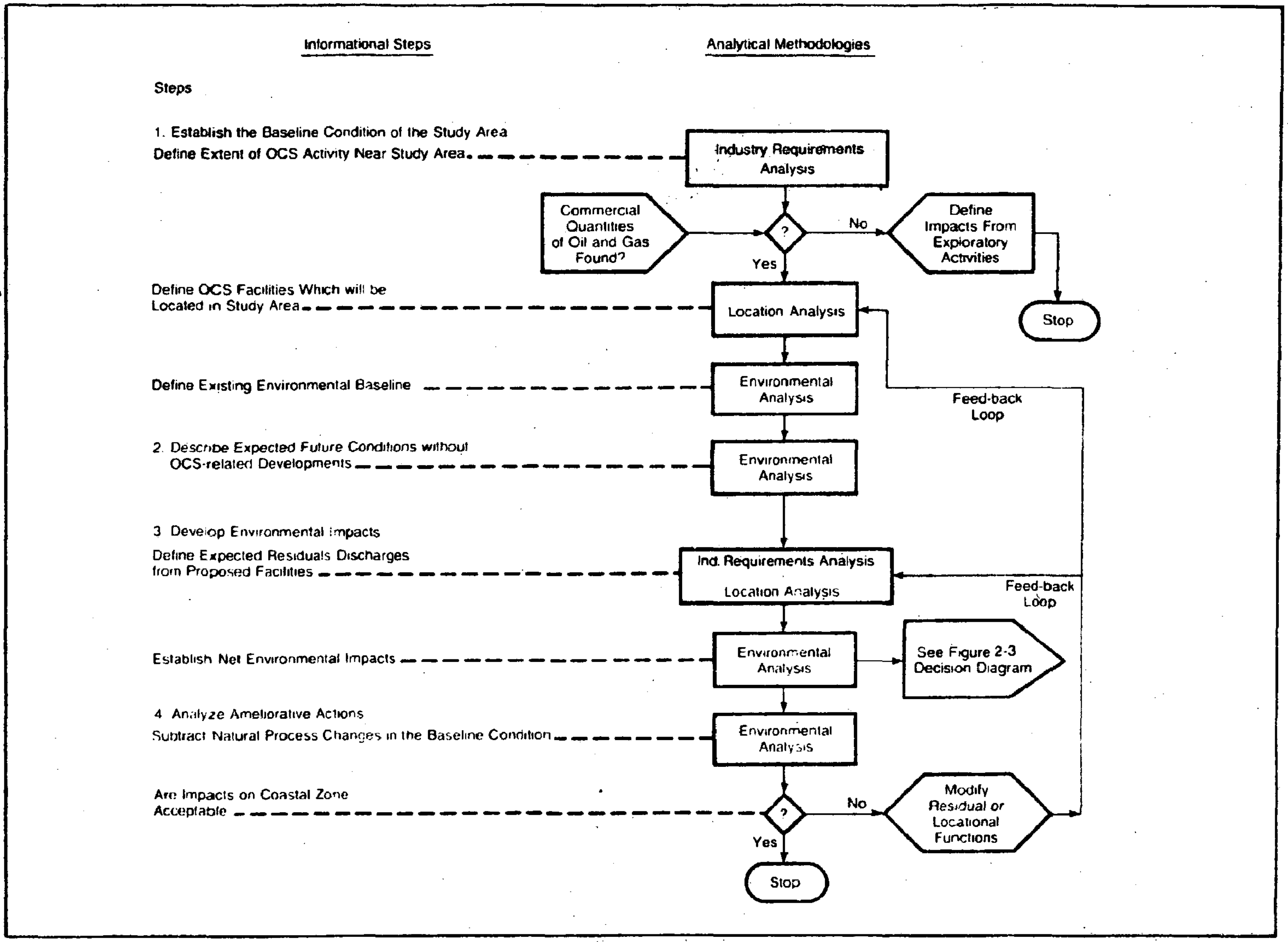


FIGURE 7-1 ANALYTICAL FLOW CHART FOR IMPACT ANALYSIS

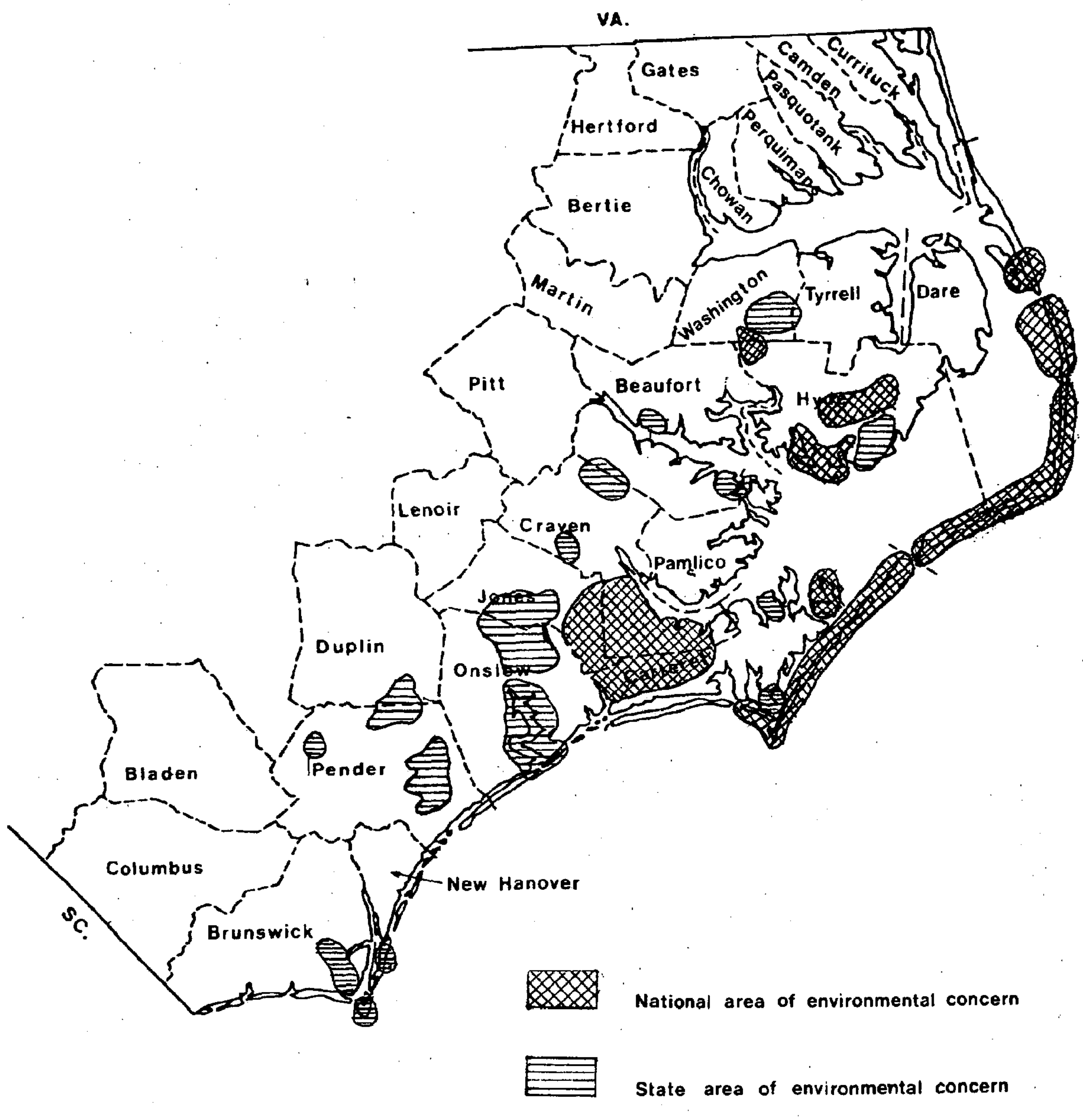


FIGURE 7-2

AREAS OF ENVIRONMENTAL CONCERN

TABLE 7.1

INPUT VARIABLES, DATA SOURCES, PROCEDURES/METHODOLOGIES, AND OUTPUT VARIABLES FOR ENVIRONMENTAL ANALYSIS

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
1. Baseline inventory of environmental systems	U.S. Dept. of Interior, DEIS For Lease Sale No. 56; Center for Natural Areas, A Summary and Analysis of Environmental Information on the Continental Shelf and Blake Plateau From Cape Hatteras to Cape Canaveral; Planners Inc., A Socio Economic Environmental Baseline Summary for the South Atlantic Region Between Cape Hatteras, North Carolina and Cape Canaveral, Florida	WESTON Methodology: Chapter 5, Section 2	Tables and maps outlining environmental systems
2. Disturbances related to industrial activity	NERBC, Factbook; WESTON, Chapter 5, Appendices A, B, C, D	Used to translate industry requirements into environmental impacts	N.A.
3. Industry requirements for OCS oil and gas activity	Development scenarios (see Chapter 3; U.S. Dept. of Interior, DEIS For Lease Sale No. 56	WESTON Methodology: Chapter 5, Section 2; CF, Vol. 3	Baseline and impact estimates of environmental impacts
4. Transportation requirements for non-OCS energy projects	Development scenarios (see Chapter 3)	WESTON Methodology: Chapter 5, Section 2 CF, Vol. 3	Baseline and impact estimates of environmental impacts

8.0 RECREATIONAL IMPACTS

The purpose of the recreational impact assessment is to forecast the pressures exerted on coastal recreational resources by the energy projects' development. To estimate the recreational impacts, two forecasts will be produced, i.e., the baseline forecast without development, and an impact forecast given the development scenarios.

In this chapter, a series of steps for developing the baseline and impact forecasts are described. A review of the assessment methodologies does not identify a specific approach to examine the recreational impacts of development. The approach discussed is consistent with the approaches used for the other elements of the impact assessment process.

8.1 Definition of Recreational Impacts

The identification and assessment of recreational impacts must begin with definitional problems which may be unique to the coastal study area. Specifically, recreational sites in the coastal study area serve not only the permanent, local population, but they also serve large temporary, non-local populations from other areas of North Carolina and other states. In fact in many coastal counties, the demand for recreational sites is greater from the non-local population than the local population (Maiolo and Tschetter, 1979).

The assessment of recreational impacts relates recreational resources to total population. Recreational resources are stated in terms of the number and acres of parks, beaches, marinas, piers, and launching sites. For the purposes of assessing recreational impacts, total population includes two sub-populations, i.e., the permanent, resident population and the temporary, recreational population. Unlike the other baseline forecasts, the estimates for future recreational needs must take into account this temporary, recreational population.

8.2 Selection of Analysis Procedures

Recreational analysis involves the development of an inventory of present and planned recreational facilities by type and a comparison of these facilities with baseline and impact demand forecasts. An initial visual inventory of recreational sites is shown in Figures 8.1. and 8.2. Examination of the figures shows an extensive system of federal and state parks, wildlife areas, lakes, public and private marinas, and fishing piers. These physical sites together with miles of private beaches represent the recreational environment for the impact analysis.

The forecast of recreational impacts from the development of the energy projects will use the output from the other elements of the assessment process as inputs. Relevant units include industry requirements, social-demographic impacts, and environmental impacts.

The industry requirements will provide estimates of the location and land needed, and the transportation needs and corridors for the respective energy projects. The industry data will allow analysis of potential competition and/or conflicts with recreational activities. For example, increased barge traffic or oil and gas platforms may compete with recreational fishing by restricting or precluding certain types of fishing gear.

The output from the environmental assessment will be used to identify recreational sites and activities which may be impacted by development. For example, disruption of marine environments caused by increased ship traffic may affect the "desirability" of sites for swimming or fishing.

The output from the demographic projections combined with projections of growth in the temporary, recreational population will be added to permanent, resident population to estimate the total demand for recreational facilities. The projections for the temporary, recreational population will be used by the approach developed by Maiolo and Tschetter (1979).

8.3 Data Sources and Methodologies

In Phase II, the data that serve as inputs for the estimation of recreational impacts will come from two sources. First, the data on the

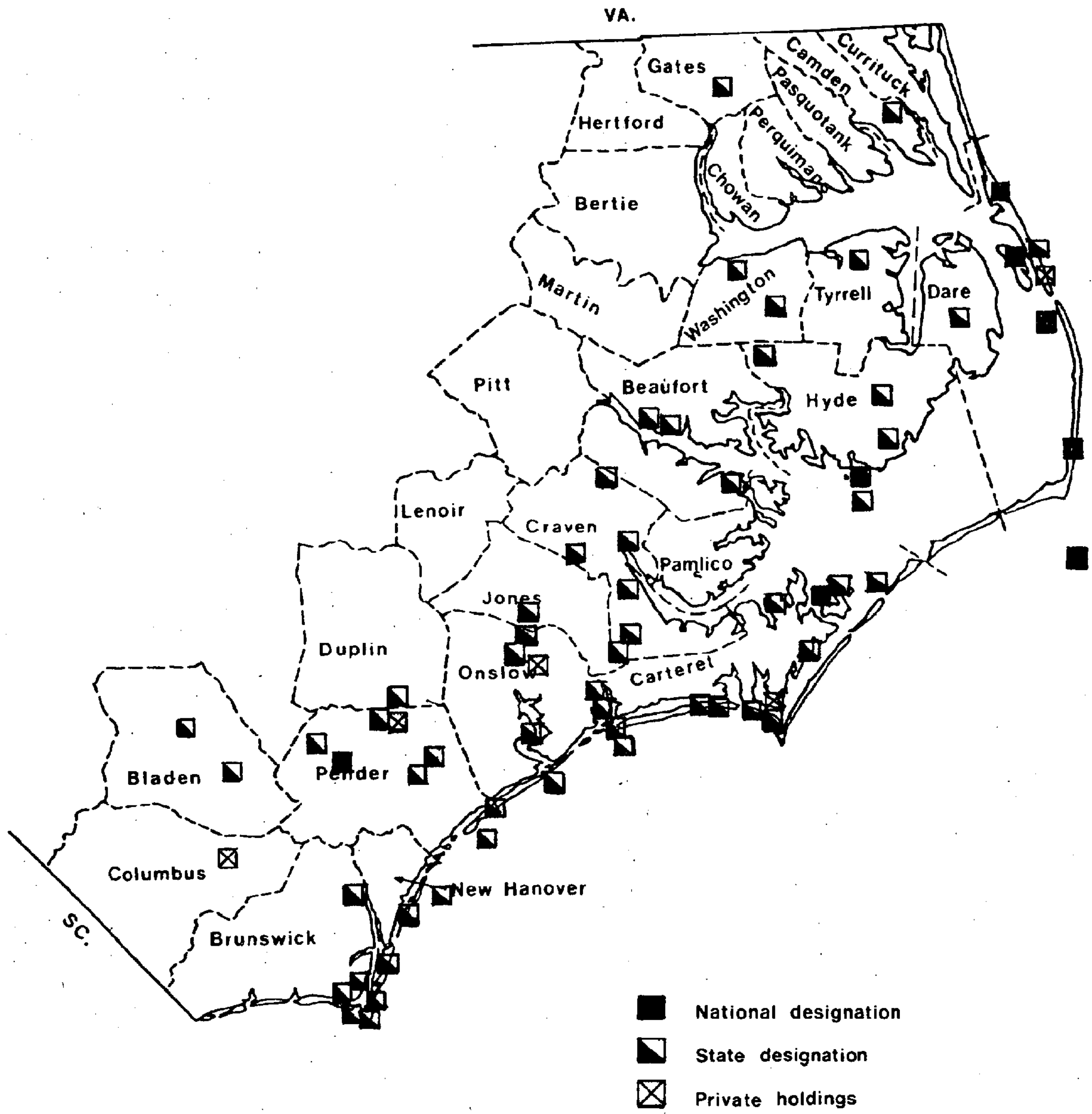


FIGURE 8-1

NATURAL AND RECREATIONAL AREAS

FIGURE 8-2

BEACHFRONT RECREATIONAL FACILITIES

permanent, resident population, and industry requirements will come from the output of other sections of the impact analysis units. Second, data on recreational sites and activities and the temporary, recreational population will come from secondary sources.

Table 8.1 identifies the specific data needs, data sources, methodologies to be applied, and data outputs for the Phase II recreational baseline and impact forecasts. Throughout Phase II, data sources will be monitored to revise and update the forecasts.

TABLE 8.1

INPUT, VARIABLES, DATA SOURCES, PROCEDURES/METHODOLOGIES, AND OUTPUT VARIABLES FOR RECREATIONAL ANALYSIS

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
1. Inventory of recreational sites	N.C. Dept. of Natural and Economic Resources	Description and mapping of recreational sites	Maps providing locations of recreational activities in North Carolina
2. Permanent, resident population	Baseline and impact demographic forecasts (see Chapter 7)	Used to estimate demand for recreational sites	Combined with temporary, recreational population will provide baseline and impact total recreational demand
3. Temporary, recreational population	Maiolo and Tschetter (1979); U.S. Dept. of Interior, DEIS For Lease Sale No. 56; selected recreational studies	Projection from historical growth trends (see Shyrock and Siegel (1973); Used to estimate total demand for recreational sites	Combined with permanent, resident population will provide baseline and impact total recreational demand
4. Industry requirements	Development scenarios (see Chapter 3); U.S. Dept. of Interior, DEIS Lease Sale No. 56.	Used in determining land use for project development; mapping will identify conflict with recreational sites	N.A.
5. Population-recreational ratios	Conservation Foundation, 1978, Vol. II	Used to calculate demand for recreational site based on total recreational population	N.A.

9.0 FISCAL IMPACTS

9.1 Definition of Fiscal Impacts

The purpose of the fiscal impact assessment is to forecast the magnitude and direction of the pressure exerted on state and local governmental budgets by the development of transportation facilities in support of the respective energy projects, particularly from OCS oil and gas activity. Fiscal impact assessment will examine both sides of state and local governments--revenues and expenditures. In order to estimate the impact of the energy projects' development, two revenue-expenditure forecasts will be produced.

One forecast is the baseline fiscal projections, i.e., estimates of growth in revenues and expenditures without the energy projects' development. A second forecast is the impact-forecast given the development scenarios. Comparisons of the baseline and impact forecasts will provide estimates of the magniture, direction, and time frame for the fiscal pressures on state and local government caused by the projected developments.

9.1.1 Inputs for Fiscal Impact Assessments

The outputs from the other elements of the assessment process are used as the inputs for estimating fiscal impacts. Real personal income is the primary variable for estimating future fiscal conditions given the relationship between personal income and most tax bases and the demand for governmental services. Projections of the distribution of income and population also serve as inputs for the fiscal estimates.

In addition, the fiscal impact assessment requires an identification of relevant public services and an estimate of real changes in per-capita expenditures of governments for these services. Relevant services include public utilities, public safety, education facilities, welfare services, and recreational facilities. The Conservation Foundation (Vol. II, 1978) provides a review of the factors used in previous research to identify the level of public services required.

9.1.2 Problems and Constraints

One issue in the fiscal impact assessment is that with potentially large developments, especially OCS oil and gas activity, it has been recognized that it is possible for one governmental unit to receive the development-derived revenues while another unit becomes a residential community and must provide governmental services without the added revenue base. To deal with this problem, the fiscal analysis will deal with the impacts on both the state and county levels.

Another issue is that the estimates of fiscal impacts cannot be accurate estimates of state and local expenditures and revenues since it is impossible to forecast discretionary fiscal responses to changes in fiscal conditions. Approximately one-half of the increase in state and local revenues between 1962 and 1972 were due to discretionary increases in effective tax rates (Roy F. Weston, Inc., Vol. II, 1978). The comparisons of the baseline and impact forecasts only indicate the nature and timing of the new pressures which tend to unbalance budgets.

9.2 Selection of Analytical Procedures

9.2.1 General

The most comprehensive view of the methodologies for estimating the fiscal impacts of development is provided by WESTON (Roy F. Weston, Inc., Vol. II, 1978). The three methodologies reviewed are the public sector component of the Curtis Harris Model, the WESTON programmed methodology, and a combination of state and local forecasts and the WESTON methodology. All three methodologies project general fiscal impacts for the state and local levels. The MARYLAND methodology (Rogers & Golden, Inc., Vol. III, 1977) provides an approach for assessing specific fiscal impacts once specific site proposals are made.

For this research, the initial assessment of fiscal impacts will look at general impacts. Given the extended time frame for OCS development, the WESTON programmed methodology provides the best alternative for the long range impact analysis desired. A single baseline fiscal projection will be used for all energy projects.

9.2.2 Methodology Organization

In the WESTON approach (Roy F. Weston, Inc., Vol. II, 1978), total revenue and expenditure data are disaggregated and each type of revenue and expenditure is projected separately. When the projections are completed, the results are aggregated to arrive at total revenues and expenditures. The totals reflect projected surpluses and deficits. The disaggregations involve four categories: state revenues, state expenditures, county revenues and county expenditures.

In general, the forecasts are based on historical trends between various economic or demographic variables, e.g., personal income or population, and a given revenue or expenditure category, e.g., income tax revenues or education expenditures. This procedure does not assume a fixed tax structure since the ratios constructed will reflect changing tax structures. Depending on the category of revenue and expenditure, the trends are constructed from either national or county specific data. The projections are in constant dollars, and an inflation multiplier will be used to adjust for the effects of inflation.

9.2.3 Projection Methods

Three approaches will be used for the fiscal projections: the modified-trend, the expenditure-related, and the population-load (Roy F. Weston, Vol. II, 1978). The modified-trend methodology is used to project ratios of revenues to personal income. The expenditure-related methodology is used to project ratios of revenues to expenditures. These two methods are used for the four categories of revenues and expenditures. The population-load methodology is used to project population-related expenditures. The population-load methodology is used for state and county expenditures.

9.3 Data Sources and Procedures

In Phase II, the data that serve as inputs for the estimation of fiscal impacts will come from two sources. First, data on personal income, income distribution and population for forecasting baseline and impact revenues and expenditures will come from the economic, socio-demographic, and recreational analysis units. Second, data used to establish historical and current trends in fiscal revenues and expenditures will come from secondary sources.

Table 9.1 identifies the specific data needs, data sources, methodologies to be applied, and data outputs for the Phase II fiscal baseline and impact forecasts. Throughout Phase II, data sources will be monitored to revise and update the forecasts.

TABLE 9.1

INPUT VARIABLES, DATA SOURCES, METHODOLOGIES/PROCEDURES, AND OUTPUT VARIABLES FOR FISCAL ANALYSIS

Input Variables	Data Sources	Procedures/ Methodologies	Output Variables
1. State revenues	U.S. Dept. of Commerce, State Government Finances	WESTON Methodology: Chapter 6, Section 1	Baseline and impact forecasts of state revenues
2. State expenditures	U.S. Dept. of Commerce, State Government Finances	WESTON Methodology: Chapter 6, Section 2	Baseline and impact forecasts of state expenditures
3. County revenues	U.S. Dept. of Commerce, Census of Government; County records	WESTON Methodology: Chapter 6, Section 3	Baseline and impact forecasts of county revenues
4. County expenditures	U.S. Dept. of Commerce, Census of Government; County records	WESTON Methodology: Chapter 6, Section 4	Baseline and impact forecasts of county expenditures
5. Population size	Baseline and impact demographic forecasts (see Chapter 7)	Used in WESTON population-load methodology for fiscal forecasts	N.A.
6. Personal income	Baseline and impact economic forecasts (see Chapter 6)	Used in WESTON methodologies for fiscal analysis	N.A.
7. School enrollments	National Center for Education Statistics, Statistics for Public Elementary and Secondary Day Schools, U.S. Dept. of Interior, DEIS. Lease Sale No. 56.	Used in WESTON population-load methodology for state and county expenditures on education (WESTON, Chapter 6, Appendix B)	N.A.
8. Population below poverty line	Baseline and impact demographic forecasts (see Chapter 7)	Used in WESTON population-load methodology for state and county welfare expenditures (WESTON, Chapter 6, Appendix C)	N.A.

10.0 PHASE II STUDY DESIGN SUMMARY

10.1 Methodological Findings

In Phase I we have reviewed and attempted to select appropriate methodologies for the impact assessment to be completed in Phase II. Additionally, the methodologies developed will allow policy-makers to monitor development beyond the life of Phase II. The review of methodologies indicates that existing approaches allow considerable discretion in the level of extensiveness and complexity of impact assessment desired, yet the methodologies are similar enough to allow for various combinations of work elements to meet the unique goals and problems of the specific research effort.

The Phase I effort has identified the energy projects presently proposed for the Coastal Study Area and developed preliminary estimates of transportation needs for the respective projects. Additionally, the transportation infrastructure for the Coastal Study Area has been inventoried. Possible changes in the transportation systems due to development have been identified. The preceding five chapters have described the substantive context in which the impact assessment will take place in Phase II.

Additionally, the findings indicate that the parameters for selecting a methodology are the needs of the ultimate users of the research, the specific types of impacts to be assessed, the time frame for the assessment, the areal units for the impact analysis, and the limitation on the impact analysis.

State and local governmental units which will be the ultimate users of the research have been identified and will be useful for two purposes in Phase II. First, the analysis of the policy framework for development will examine the policies and regulations of relevant agencies. Second, an advisory committee representing a cross-section of identified ultimate users has been formed.

Impacts to be examined include economic, social, recreational, environmental, and fiscal. The analysis will focus on general and specific impacts from the respective projects. General impacts measure effects on the Coastal Study Area, and the unit of analysis for the impact assessment is the entire twenty-seven county area. Specific impacts measure effects which are energy project site specific, and the unit of analysis is the county or counties in which the energy project is located.

Although the impact analysis is presented as a series of discrete analytical units, the theoretical and empirical interrelationships between the units indicate that a methodology which integrates the assessment units is desirable The WESTON methodology (Roy F. Weston, Inc., 1978) provides a methodological framework that: (1) provides alternative methodologies for each impact assessment unit, (2) provides methodologies for both general and specific impact analyses, (3) integrates the input and output from respective assessment units, (4) allows substitution from other methodologies for specific impact analysis units, and (5) allows periodic updates of the development scenarios for the impact analyses.

Data requirements for the impact assessment include historical and present conditions for each of the five analytical units and development scenarios for the respective energy projects. Data describing economic, social-demographic, environmental, recreational, and fiscal trends and conditions will be derived from secondary sources. Initial data for the generation of development scenarios will be derived from secondary sources, e.g., environmental impact statements, county land use plans, and from contacts with the project developers. Preliminary development scenarios have been included in this report, and these scenarios will be updated as more specific energy project proposals become available during Phase II.

The actual impact assessment will involve two steps. First, a series of baseline forecasts of future conditions without the effects of the proposed energy projects are necessary. Baseline forecasts will be done for the entire twenty-seven county study area and for the respective counties in which projects are proposed. Second, a series of impact forecasts with the effects of primary and secondary development will be developed for each of the energy projects. Impact forecasts will be carried out for the entire twenty-seven county study area as well as specific forecasts for the respective counties in which the projects are located. Impact forecasts will be periodically updated as new development data becomes available. This will be the function of the "project monitoring" task in Phase II.

Finally, our review of methodologies indicates that, to be useful to policy makers, the impact assessment must take into account the policy framework in which development will occur. The siting of particular projects, e.g., OCS support bases, coal terminals, etc., and the ability to manage the primary and secondary development resulting from these projects are dependent on federal, state and local policies, regulations, and plans.

10.2 Implications for Phase II Research Design

The findings summarized in the preceding section and detailed in the body of the report have implications for the research design of Phase II. The design for Phase II falls generally into eight steps:

(1) The compilation of the data base describing historical and current conditions for the economic, social-demographic, environmental, recreational, and fiscal analytical units;

(2) The identification and analysis of federal, state, and local policies, regulations and plans affecting management of the development of the energy projects and transportation systems in the coastal study area;

(3) The generation and monitoring of development scenarios identifying industry requirements and transportation needs for each of the proposed energy projects;

(4) The examination of general location alternatives where site-specific plans have not been developed by private industry;

(5) The generation of base line forecasts of development in each of the impact areas based on historical trends and without the proposed energy projects;

(6) The generation of impact forecasts of transportation development in each of the impact areas based on energy project development scenarios;

(7) The analysis of alternative modes of transportation and development strategies; and

(8) The monitoring of energy projects and transportation development throughout Phase II to periodically update the assessment process.

The various stages can be chronologically ordered and expressed as milestones during Phase II. A detailed research design is provided in Appendix B.1 outlining tasks and subtasks. As a two-year project Phase II will focus on the impacts of transportation requirements for the potential OCS support bases and the potential coal export terminals in the first year (Phase IIA) and the remaining energy projects during the second year (Phase IIB). Procedures similar to the above eight steps will apply to both OCS and coal (Phase IIA) and the other energy projects.

Although OCS oil and gas exploration as well as coal export activity will be monitored during the second year of the project, the focus in Phase IIB will shift to the remaining energy projects. The development scenarios and transportation needs for the refineries, peat projects, the aluminum smelter, the peat mining projects wood energy projects will be identified. Additionally, any new proposed energy projects in the coastal study area will be identified and development scenarios generated. Preliminary forecasts of the impacts of the transportation requirement of these projects on environmental and recreational resources will be produced.

Throughout Phase II the impact assessment process will use the research design from the WESTON methodology (Roy F. Weston, Inc, 1978). The results of the analysis will be presented with reference to the policy framework for coastal development to provide policy makers a perspective for interpreting the results of the research.

Outputs of the Phase II research project will benefit State and local planners and decision-makers responsible for all modes of transportation, as well as various industries investing in coastal area and OCS energy projects, by identifying and analyzing benefits and costs of the various transportation investments. It will also provide a "fact book" on observed impacts as well as future potential impacts of alternate transportation facilities needed to support energy-related projects. This fact book will provide essential information to policy planners, particularly with respect to port and highway facilities. It will also lay the groundwork for a multi-modal analysis of future transportation investments east of Interstate 95 in North Carolina. Local and county land use planning groups and economic development interests in the State and Coastal Plains Region will also find information in this fact book a useful aide in analyzing site requirements for energy activity development.

10.3 Recommendations

In the course of developing the research methodology for the Phase II impact assessment, several research problems have been identified for further study. While these research problems are outside the scope of the research envisioned for Phase II, they do merit further consideration and are briefly presented in this section.

10.3.1 Time Frame for Monitoring and Evaluation

As seen in Chapter 4, the time frame for development of the respective energy projects varies considerably due to the time required for plan development, the permitting process, and the construction process. Realistically, several of the projects may not reach the construction phase, let alone operational status during the life of Phase II. Since the details of the structure of the actual energy projects can change during the stages of development, accurate impact assessment forecasts, let alone the dimensioning of actual impacts, require that policy makers employ the methodologies chosen for Phase II on an ongoing basis. The time during which Phase II will be carried out limits the ability to monitor and assess the impacts of the energy projects to two years, a problem which will be addressed by submitting to the Coastal Energy Impact Program a proposal for funding for an additional year beyond Phase II.

10.3.2 Expansion of Geographical Coverage

A second research topic identified during Phase I is the definition of the coastal zone. While the Coastal Zone Area and the coastal study area are defined by federal and state statutes, reasons based on practical arguments exist for treating the forty-one counties in North Carolina that are a part of the Coastal Plains Region as a unit for the same type of analysis. Theoretical reasons for extending the study area include the economic, social-demographic, and geographical integration of these coastal plain counties, which serve to define the hinterlands for the proposed energy projects. Additional energy-related projects, and their impacts on the transportation system, also need to be defined for this entire region. The extension of the Coastal Study Area to reflect the extensiveness of the Coastal Plains Region would provide a better base for the impact assessment, but will require funding from sources other than the Coastal Energy Impact Program.

10.3.3 Modal Analysis of Coal Transportation

Third, the preliminary analysis of transportation requirements for the respective energy feedstocks and products suggests that a detailed modal analysis, which includes an analysis of alternative transportation modes would be desirable. For example, the proposed development of the coal export terminals involves a transportation network to move the feedstock from Appalachian mines to the ports and onto ships. Alternatives such as a slurry pipeline or a rail-barge combination should be explored. Impacts are likely throughout the transportation system as the coal is moved through North Carolina and other states from its origins to its destinations. Additionally, it is likely that the magnitude of the impacts will be directly related to the level of export. Our recommendation is that the impacts of energy feedstock transportation, particularly coal, should be investigated throughout the state of North Carolina.

10.3.4 Application to Non-Energy Projects

A fourth research topic concerns the application of the Phase II methodology to transportation problems associated with the development of non-energy projects in the coastal area. Projects would include both industrial and non-industrial development such as agricultural commodities. Reasons for such a recommendation are the inherent interaction effects between the development of energy and non-energy projects and the competition for resources between energy and non-energy projects. Additionally, demonstrating the efficacy of the Phase II methodology for non-energy projects would demonstrate the methodology's usefulness for policy makers.

10.3.5 Application to Other Regions

Additionally, in a matter entirely outside the geographical scope of the Coastal Plains Region of the state, an analysis similar to the one being conducted in this study needs to be applied to other regions in North Carolina, particularly the mountain area. With the exploration for oil and other energy resources within this area projected to increase in the next several years, possibly leading to production, federal, state and local policy makers may find it expedient now to explore possible development impacts on the transportation system in Appalachia, both for North Carolina and as a whole. The methodology could also be expanded to all states in the Coastal Plains Region. Methodologies utilized in this study could be adjusted for use in such an analysis.

10.4 Summary

In conclusion, this section has recommended ways in which the insights gained in Phase I can be extended and the usefulness of the research protocols can be broadened for policy makers. These recommendations, together with the Phase II research, provide a research agenda for monitoring and managing future development in the coastal area and in other areas of North Carolina, particularly those related to the major key facilities of energy and transportation facilities.

APPENDIX A.1

LISTS OF CONTACTS

APPENDIX A.1.1. LIST OF PERSONAL CONTACTS, CEIP TRANSPORTATION STUDY

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Hobart Trusdale	President First Colony Farms, Inc.	Route 1 Creswell, NC 27928 #733-4131
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APPENDIX A.1.2. LIST OF CONTACTS BY MAIL, CEIP TRANSPORTATION STUDY

NAME	TITLE/ORGANIZATION	ADDRESS
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Lamar A. Benton	Chairman Board of Commissioners Gates County	P. O. Box 414 Gatesville, NC 27938
J. B. Berry	Chairman Board of Commissioners Hyde County	P. O. Box 253 Swan Quarter, NC 27885 #926-5711
Ledrue Buck	Chairman Board of Commissioners Beaufort County	W. Second St. Washington, NC 27889 #946-0070
W. Raleigh Carver	Chairman Board of Commissioners Pasquotank County	P. O. Box 272 Elizabeth City, NC 27909 #335-0865
William J. Costin	Chairman Board of Commissioners Dublin County	P. O. Box 158 Kenansville, NC 28349 #296-1591
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Charles H. Edwards	Chairman Board of Commissioners Bertie County	P. O. Box 530 Windsor, NC 27983 #726-6848
J. D. Flowers	Chairman Board of Commissioners Hertfort County	P. O. Box 116 King St. Winton, NC 27983 #358-3551

NAME	TITLE/ORGANIZATION	ADDRESS
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Thomas B. Gray	Chairman Board of Commissioners Dare County	P. O. Drawer 1000 Manteo, NC 27954 #473-2143
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NAME	TITLE/ORGANIZATION	ADDRESS
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APPENDIX A.2

STUDY ADVISORY COMMITTEE

APPENDIX A.2. TRANSPORTATION STUDY ADVISORY COMMITTEE, COASTAL ENERGY IMPACT PROGRAM

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James F. Smith (Ex-offico member)	CEIP Coordinator Office of Coastal Management N.C. Dept. of Natural Resources & Community Development	P. O. Box 27687 Raleigh, NC 27611 #733-2293
Yates Sorrell (Co-Chairman)	Professor Dept. of Mechanical Aerospace Engineering N.C. State University	Broughton Hall Raleigh, NC 27607 #737-2684

NAME	TITLE/ORGANIZATION	ADDRESS
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APPENDIX B.1

WORK PLAN FOR PHASE II

Phase II-A. Assessment of Impacts of OCS Support Base and Coal Export Activity

Task 2.1. Determine Industry Requirements

2.2.1 Base Line Data

Collect base line data on population and demographic indicators, economic indicators, community and county characteristics, transportation facilities, and energy resources, and energy-related activities for those counties impacted by OCS and by coal projects.

2.1.2 Industry Needs-OCS

Develop complete compilation of industry needs under alternative scenarios involving various OCS levels of development (i.e., low, medium, and high resource recovery scenarios).

2.1.3 Industry Needs-Coal

Develop complete compilation of industry needs under alternative scenarios involving various levels of coal export (i.e., low, medium, and high export volume scenarios).

Task 2.2. Analyze Policies Affecting Development

2.2.1 Energy-Related Policies

Identify, analyze, and describe in a condensed fashion for policy-makers, the federal, state, and local policies, regulations and plans affecting management of energy project development in the coastal study area.

2.2.2 Transportation-Related Policies

Identify, analyze, and describe in like manner the federal, state, and local policies, regulations and plans affecting management of transportation system development in the coastal study area.

2.2.3 Monitoring

Monitor energy projects and general development trends in the coastal study area to periodically update the assessment process.

Task 2.3. Examine Location Alternatives for OCS Support Bases

2.3.1 Shore Support Requirements

Determine requirements for shore support facilities for OCS activity off the South Atlantic coast, concentrating on Cape Henry to Jacksonville, under three separate scenarios.

2.3.2 Site Specific Needs

Delineate needs in terms of land, port facilities, channel depths, utilities, transportation links, easements, and other peripheral facilities.

2.3.3 Optimal Number of Sites

Determine the optimal number of shore support sites for OCS exploration and development along the North Carolina, South Carolina, and Georgia coast.

2.3.4 North Carolina Site(s)

Using those sites identified in Phase I as a start, identify and analyze all possible sites in North Carolina including, but not limited to Wilmington, Morehead City, Southport, and Wanchese.

2.3.5 Recommendations

Recommend optimal site(s) in North Carolina for the location of OCS on-shore support bases.

2.3.6 Advantages of N.C. Site(s)

Describe special factors that offer an advantageous location of shore support facilities in North Carolina.

2.3.7 Improvements Needed

Identify transportation and other improvements needed (and attenuating costs) to make alternate location sites viable support bases, and analyze the relationship of OCS support base(s) to other on-shore facilities.

Task 2.4. Examine Location Alternatives for Coal Export Terminals

2.4.1 Export Demand

Review projections of world coal demand and export potential for the South Atlantic range of ports (i.e., Norfolk/Chesapeake, Morehead City, Wilmington area, Charleston, and Savannah).

2.4.2 Alternatives

Assume alternate development scenarios for the level of potential coal export volume from North Carolina ports.

2.4.3 Long-Range Needs

Delineate long-range needs in terms of land, port facilities, channel depths, utilities, transportation links, easements, and other peripheral facilities. (Short-range needs have already been identified by the State Ports Authority).

2.4.4 North Carolina Sites

Using those sites identified in Phase I as a start, identify all possible coal export terminal sites in North Carolina.

2.4.5 Advantages of N.C. Sites

Describe special factors that offer an advantageous location for these sites, where applicable.

2.4.6 Improvements Needed

Identify transportation and other improvements needed, along with costs to utilize those sites.

Task 2.5. Forecast Impacts of OCS and Coal Activity Based on Industry Requirements

2.5.1 Analyze Base Line Data

Analyze base line data for alternative locations of support base facilities in order to assess economic impacts, social and demographic impacts, recreational impacts, fiscal impacts, and environmental impacts.

2.5.2 Impacts-Exploration Stage-OCS

Estimate potential impacts during the OCS exploration stage given alternative industry requirements scenarios identified in subtask 2.1.2.

2.5.3 Impacts-Operation Stage-OCS

Estimate potential impacts during OCS continuing operations stage, given alternative industry requirement scenarios.

2.5.4 Analyze Base Line Data

Analyze base line data for alternative locations of coal export terminals in order to assess economic, social-demographic, recreational, environmental, and fiscal impacts.

2.5.5 Impacts-Coal

Estimate potential impacts of coal export activity under alternative industry requirement scenarios.

Task 2.6. Analyze Transportation Alternatives

2.6.1 Identify Target Projects

Identify those coal export sites and OCS support base sites where alternative transportation modes or systems should be considered.

2.6.2 Alternate Transportation Systems

Analyze advantages and disadvantages including costs of using feasible alternate modes or systems.

2.6.3 Policy Conflicts

Examine policies affecting development of alternate modes for possible conflicts with overall coastal management plans and policies.

Phase II-B. Assessment of Impacts of Transport and Storage Related to Other Energy Projects

Task 2.7. Validate Phase I Data and Other Information

2.7.1 Review Energy Projects

Review energy projects identified in Task 1.1 to determine if any new projects are planned or anticipated concerning peat, refinery products, LPG, wood, etc.

2.7.2 Review Transportation Projects

Review transportation infrastructure investments identified in Task 1.2 to determine if modifications need to be made as a result of recent energy-related developments.

2.7.3 Update Interview Information

Update current situtation, if needed, through interviews with State, regional, and local decisionmakers.

Task 2.8. Determine Industry Requirements

2.8.1 Base Line Data

In subtask 2.1.1, base line data were collected for those counties in the coastal zone that would be impacted by OCS development. In this task, this data base will be extended to all additional counties (that were not included in subtask 2.1.1) where peat, wood, and other energy resources are, or may in the future be exploited and harvested as an energy source.

2.8.2 Industry Needs

Develop a complete compilation of industry needs under alternative scenarios involving energy development (i.e., low, medium, and high resource recovery scenarios).

2.8.3 Compile Data Base

Compile all base line data from tasks 2.1 and 2.5 into a uniform data base for all coastal counties included in the study.

Task 2.9. Monitor Near-Term Impacts in Order to Forestall Mitigation

2.9.1 Monitor Impacts of Shipments

Assess impacts of energy feedstock and product shipments that may have occurred since the project began.

2.9.2 Monitor Impacts of Projects

Assess transportation projects that have been undertaken in support of energy activity to identify recreational and environmental impacts that may have occurred.

Task 2.10. Forecast Long-Term Impact of Transportation Investments Based on Industry Requirements

2.10.1 Analyze Base Line Data

Analyze base line data for those counties potentially impacted by wood, peat, LPG, refineries, etc. in order to assess fiscal, recreational and environmental impacts.

2.10.2 Impacts-Construction Stage

Estimate potential impacts given alternative industry requirement scenarios identified in subtask 2.8.2 that may occur during the construction and development stage.

2.10.3 Impacts-Operation Stage

Estimate potential impacts given alternative industry requirements during the continuing operations stage.

Task 2.11. Analyze Transportation Alternatives

2.11.1 Identify Target Projects

Identify those energy projects where alternative transportation modes or systems should be considered.

2.11.2 Alternate Transportation Systems

Analyze advantages and disadvantages including costs of using feasible alternate modes or systems.

Task 2.12. Compile and Complete Final Report

Major interim reports will be prepared on this project according to the following schedule:

August 1980: Preliminary Draft, Phase I Report (current grant)

December 1980: Final Draft, Phase I Report (current grant)

May 1981: Preliminary Draft, Phase II Report on OCS Support Base Study and Coal Export Terminal Study

August 1981: Final Draft, Phase II Report on OCS Study and Coal Study

May 1982: Preliminary Draft, Phase II Report on Other Coastal Study Area Energy Projects

August 1982: Final Draft, Phase II Report on Other Coastal Energy Projects

This task will compile these separate reports into a final technical report and will prepare an executive summary report for the overall project effort.

SCHEDULE

The overall project schedule for each major subtask of this Phase II effort is shown in the following "Grant Milestone Plan." Milestones in the project are identified by target dates for completion of tasks and subtasks and for completion of major project reports.

ORGANIZATION AND MANAGEMENT

Project organization and management will continue exactly as it is in the current Phase I effort, with Dr. Edd Hauser, Deputy Director of ITRE, serving as overall Project Director and Dr. Paul Cribbins of N.C. State University and Dr. Paul Tschetter of East Carolina University serving as Co-Principal Investigators. The project team will be enhanced also by the continued involvement of Dr. John Maiolo and Dr. Rooney Malcom as Advisory Consultants. Phase II Project Associates will be Dr. Mark Fisch and Mr. Dan Latta. Other professional and graduate student personnel will be utilized on specific subtasks as needed.

An additional feature of Phase II of the Coastal Energy Transportation Study project will be the close collaboration between the ITRE project team and North Carolina State Ports Authority. Mr. Grant Godwin, Deputy Director for Plans, will serve as the SPA Project Director and will be heavily involved in Phase II-A, the analysis of OCS support base and coal export terminal requirements.

GRANT MILESTONE PLAN

1. Grant Identification No. 23254	2. Task Number
3. Task Identification	Phase II-A: CEIP Transportation Study
4. Planning Period	through
5. Performer (Name, Address)	UNC Institute for Transportation Research and Education
6. Task Start Date	Sept. 15, 1980
7. Task Completion Date	August 31, 1981

8. Identification Number	9. Planning Category (Work Breakdown Structure Element)	10. Budget Period in Months 1980 Sept.	Oct.	Nov.	Dec.	1981 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	11. Contractual/Agreement (Name of Performer) Responsible
Tasks 2.1-2.3	OCS Support Base and Coal Export Study													
2.1.1	Base line Data													Tschetter
2.1.2	Industry Needs - OCS													Cribbins
2.1.3	Industry Needs - Coal													Cribbins
2.2.1	Energy-Related Policies													Hauser
2.2.2	Transp.-Related Policies													Hauser
2.2.3	Monitoring													Hauser
2.3.1	Shore Support Requirements													Cribbins
2.3.2	Site Specific Needs													Cribbins
2.3.3	Optimal Number of Sites													Cribbins
2.3.4	North Carolina Site(s)													Godwin
2.3.5	Recommendations													Godwin
2.3.6	Advantages of N.C. Site(s)													Godwin
2.3.7	Improvements Needed													Cribbins

12. Remarks

△-Subtask Completion Target Date: ▽-Interim Report Target Date

13. Signature of Program Manager and Date

14. Signature of Government Representative and Date

GRANT MILESTONE PLAN

1. Grant Identification No.	2. Task Number	3. Task Identification	4. Planning Period
23254		Phase II-A (Continued)	through

5. Performer (Name, Address)

6. Task Start Date

7. Task Completion Date

8. Identification Number	9. Planning Category (Work Breakdown Structure Element)	10. Budget Period in Months 1981 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.					11. Contractual/Agreement (Name of Performer)
Tasks 2.4 -2.6	OCS Support Base and Coal Export Study													
2.4.1	Export Demand													Godwin
2.4.2	Alternatives													Godwin
2.4.3	Long-Range Needs													Godwin
2.4.4	North Carolina Sites													Godwin
2.4.5	Advantages of N.C. Sites													Godwin
2.4.6	Improvements Needed													Godwin
2.5.1	Analyze Base line Data-OCS													Tschetter
2.5.2	Impacts-Exploration Stage-OCS													Tschetter
2.5.3	Impacts-Operation Stage-OCS													Tschetter
2.5.4	Analyze Base line Data-Coal													Tschetter
2.5.5	Impacts-Coal													Tschetter
2.6.1	Identify Target Projects													Cribbins
2.6.2	Alternate Transp. Systems													Cribbins
2.6.3	Policy Conflicts													Cribbins

12. Remarks

13. Signature of Program Manager and Date

14. Signature of Government Representative and Date

GRANT MILESTONE PLAN

1. Grant Identification No.	2. Task Number	3. Task Identification	4. Planning Period
23254		Phase II-B: CEIP Transportation Study	through

5. Performer (Name, Address)	6. Task Start Date	7. Task Completion Date
UNC Institute for Transportation Research and Education	May 1, 1981	August 31, 1982

8. Identification Number	9. Planning Category (Work Breakdown Structure Element)	10. Budget Period in Months 1981 May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1982 Jan.	Feb.	Mar.	Apr.	11. Contractual/Agreement (Name of Performer)
Tasks 2.7 -2.12	Other Energy Projects Study													
2.7.1	Review Energy Projects	△												Cribbins
2.7.2	Review Transportation Projec	△												Cribbins
2.7.3	Update Interview Information		△											Cribbins
2.8.1	Base line Data				△									Tschetter
2.8.2	Industry Needs				△									Cribbins
2.8.3	Compile Data Base						△							Tschetter
2.9.1	Monitor Impacts of Shipments				△						continue →			Cribbins
2.9.2	Monitor Impacts of Projects				△						continue →			Cribbins
2.10.1	Analyze Base Line Data											△		Tschetter
2.10.2	Impacts - Construction Stage													Fisch
2.10.3	Impacts - Operation Stage													Fisch
2.11.1	Identify Target Projects													Hauser
2.11.2	Alternate Transp. Systems													Cribbins
2.12	Final Report													Cribbins

12. Remarks

△-Subtask Completion Target Date

13. Signature of Program Manager and Date	14. Signature of Government Representative and Date

GRANT MILESTONE PLAN

1. Grant Identification No. 23254	2. Task Number	3. Task Identification Phase II-B (Continued)	4. Planning Period through
5. Performer (Name, Address)			6. Task Start Date
			7. Task Completion Date

8. Identification Number	9. Planning Category (Work Breakdown Structure Element)	10. Budget Period in Months 1982: May	June	July	Aug.									11. Contractual/Agreement (Name of Performer)
Tasks 2.9-2.12	Other Energy Projects Study													
2.9.1	Monitor Impacts of Shipment													Cribbins
2.9.2	Monitor Impacts of Projects													Cribbins
2.10.1	Analyze Base Line data													Tschetter
2.10.2	Impacts-Construction Stage													Fisch
2.10.3	Impacts- Operations Stage													Fisch
2.11.1	Identify Target Projects													Hauser
2.11.2	Alternate Transp. Systems													
2.12	Final Report													

12. Remarks

△-Subtask Completion Target Date ▽-Interim Report Target Date ▼-Final Report Target Date

13. Signature of Program Manager and Date	14. Signature of Government Representative and Date

APPENDIX B.2

BIBLIOGRAPHY

The references cited in this bibliography are classified under the following topics:

B.2.1 North Carolina Energy Statistics

B.2.2 North Carolina Transportation

B.2.3 Ports

B.2.4 North Carolina State Ports

B.2.5 Coal

B.2.6 Wood/Peat

B.2.7 Oil and Gas

B.2.8 OCS Impacts

B.2.9 Water Resources

B.2.10 Land Use Plans

B.2.11 Environmental Impact Statements

B.2.12 Environmental Assessments

B.2.13 Community Development and Recreation

B.2.14 Bibliographies and Data Sources

NORTH CAROLINA ENERGY STATISTICS (B.2.1)

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